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President J. M. Thomas.

Judge Thomas, the presiding officer of the Independent Telephone association at the Chicago convention, has been an earnest and consistent advocate of complete and effective organization ever since the movement was started. His selection as president at the Detroit convention last year was a natural result of his prominence in the movement and a fitting recognition of the value of his services. He became interested in the independent telephone movement just before the expiration of the fundamental Bell patents, and made the patent situation a study for some time before becoming financially interested in the building of exchanges. He has always been convinced, he says, that the claim of the American Bell for further protection under its microphone patents was intended to frighten capital and weaken opposition. Judge Thomas believed that the only effective way of meeting the Bell attacks was by securing a permanent organization of the independent interests, and he accordingly directed his efforts toward bringing about this result. As it was largely through his influence that the organization was perfected, a brief sketch of his career will prove of interest to the general public as well as those directly engaged in telephony.

James Milton Thomas resides in Chillicothe, Ohio, and is 40 years of age. He is a native of Ross county, the son of Archibald and Mary Norris Thomas, and was born on April 24, 1858. He is a descendant of Samuel Thomas, who emigrated to America in 1620 on the Mayflower, and settled in New England. His grandfather, Samuel Thomas, and grandmother, Jane Payne, were both natives of Maryland, who married and lived in Virginia until 1818, when they moved to Ohio and located a homestead in that part of Ross county which is now included in Pickaway, and is known as the Deer Creek settlement. Both the Paynes and Thomases are of Welsh descent. Archibald was the only son of Samuel Thomas and Jane Payne. He married twice, his second wife being Mary E. Norris, the mother of Judge Thomas. Her grandfather, Arnold Norris, was an officer of the Revolutionary army, in which other relatives also served. James Milton was the sixth of nine children born to Archibald Thomas and Mary E. Norris. He sprang from patriotic and Puritan ancestors, brave and reliable in the military service of the country and true to their convictions in the civil service. He worked on his father's farm and attended the district school until he was 17 years of age, having qualified himself in the meantime for teaching. For three years thereafter he engaged in teaching and in 1879 entered the Ohio Wesleyan University at Delaware with a view to completing his scholastic education. He did not remain for the full course, but resumed teaching at Clarksburg and at the same time pursued the study of law in its preliminary stages. He continued his legal studies in the office of Judge William H. Safford until his admission to the bar in June, 1884, and then immediately entered upon the practice of the law in Chillicothe. Having a good knowledge of the principles of law, a general acquaintance in the community and the full confidence of the public as well as of his colleagues at the bar, he soon built up a profitable practice, which continued to increase until 1893, when he was elected judge of probate. Judge Thomas is an active member of the Republican party, whose candidate he was for mayor in 1885. The natural Democratic majority was too great to be overcome, but he succeeded in reducing it about one-half. He was married October 18, 1887, to Miss Flora E. Wayland, whose father is a merchant of Chillicothe. Four children are the offspring of this marriage: William A., Julia E., Lulu W. and Virginia E. His membership, with that of his family, is in the First Presbyterian Church of Chillicothe. The only fraternity or benevolent society to which he belongs is the Order of Elks, and in this he is prominent.

Judge Thomas is universally popular, and he stands very high socially. Concerning his professional standing a prominent judge said: "Judge Thomas has good education and fine intellect. He has a good legal mind, is well versed in the principles of the law, is a very good trial attorney, quick to discern the strong points in his case and careful to avoid those that endanger it; is a fine commercial lawyer, but is more than a commercial lawyer—a universal lawyer is more appropriate. He is a pleasant speaker, has a ready command of language and a nice discrimination of points. In his present position he is rendering great satisfaction, being upright and thoroughly honest, and his judgments are usually satisfactory."

Judge Thomas has devoted considerable attention to patent law and litigation, especially in its bearing upon the telephone situation.

JAMES M. THOMAS.

Electrical Power for Irrigation.

Professor C. G. Baldwin of Claremont, Cal., has a scheme to bring electric power from the mountains in a portion of Riverside County, there to be sold at a low rate to the farmers for the purpose of pumping water from wells, thus making them independent of water companies and irrigation districts, from which they have suffered so much during the last few years. The power is to be derived from four feeders of Mill Creek coming in from the north, and together measuring last year at lowest water over 550 miner's inches. The largest of these streams flows out of the Great Meadow, and F. E. Brown, the well-known engineer, calls it "the wettest spot in Southern California." One tunnel, 740 feet in length, is completed, and it is the only one on the line. The survey made by the engineer, W. H. Sanders, last fall makes the gravity line four miles and a half, cut upon the mountain sides at an elevation of 7,300 feet above the sea, but still 4,000 feet below the summit of Grayback. The fall is 2,178 feet in 5,075. The power house will be located upon a piece of land purchased from J. R. Akers, who acquired the last homestead in Mill Creek Cañon. Beyond him is Uncle Sam's reservation. The power house will be some four miles above the proposed new plant of the Redlands Power company.

The new copper circuit of the Postal Telegraph-cable company between Chicago and Los Angeles, Cal., was completed on June 8th.

Independent Telephone Convention.

The second annual meeting of the Independent Telephone association of the United States is scheduled for June 30th and July 1st and 2d at the Palmer House, Chicago. The association is made up of representatives of the independent telephone exchange owners and managers in the country. It was organized in Detroit a year ago, after much discussion, at a well-attended meeting of telephone men from all parts of the country. The constitution of the association provides for the protection of operators and subscribers of independent exchanges and the establishment of a system of intercommunication between cities and villages, with a reasonable charge for such service. Membership is limited to those actually engaged in the operation of independent exchanges. Provision is made for the selection of officers and committees, and their powers and duties are distinctly stated. A salary of $2,500 a year was voted for the president, $1,000 a year for the secretary and $750 a year for the treasurer. The actual expenses of these officers are also paid by the association.

The officers of the association are: President, James M. Thomas, Chillicothe, O.; first vice-president, H. C. Young, Columbia, Pa.; second vice-president, L. K. Hime, Oskaloosa, Ia.; third vice-president, Thomas Fricker, Ashtabula, O.; secretary, W. J. Vesey, Fort Wayne, Ind.; first assistant secretary, G. W. Beers, Fort Wayne, Ind.; second assistant secretary, D. C. Dow, Cobleskill, N. Y.; treasurer, L. A. Carr, Durham, N. C.

At this week's convention in the Palmer House it is expected that the sessions will be held in the balcony club-room, behind closed doors. A meeting devoted strictly to business is anticipated, but the telephone manufacturers and supply men will doubtless be well represented.

Pacific Cable Project.

The passage by an overwhelming majority in the House of Representatives of the joint resolution for the annexation of Hawaii to the United States and the probability of like action in the Senate have caused a revival of interest in the bill to provide for telegraphic communcation between San Francisco and Honolulu. Interest in the project has also been stimulated anew by the intelligence that the Hawaiian Legislature has granted a franchise to the Pacific Cable company to lay and maintain telegraphic communication between that country and Japan and China, the operation of the franchise being conditioned on favorable action by the Congress of the United States within the next 18 months on the bill now pending before it. This bill, which was reported from the House committee on interstate and foreign commerce by Mr. Bennett of New York on March 8th, authorizes the postmaster-general to contract with the Pacific Cable company for the payment to that company of not more than $100,000 a year, payable quarterly for 20 years, for the construction and operation of a submarine cable for the transmission of messages of the United States from San Francisco to Honolulu, and thence to such points on the coasts of Japan and China as the company, with the approval of the postmaster-general, may select. The details of the arrangement contemplated in the bill were given in the Western Electrician of March 19th last. The friends of the measure are not hopeful of action by the House before next winter, unless the present session is prolonged to a date considerably later than is now expected, although they are strongly of the opinion that the work of establishing telegraphic communication between San Francisco and Honolulu should be begun as soon as annexation takes place, and vigorously prosecuted to a speedy conclusion.

The Sedalia (Mo.) Electric Railway, Light and Power company, it is stated, disposed of its entire plant to an eastern syndicate for $350,000. F. W. Child of New York has been appointed general manager, with headquarters at Sedalia. The company owns 15 miles of track, one park of 40 acres and another of 120 acres, while the lighting plant operates 160 arc and 2,000 incandescent lights. Extensive improvements are to be made at once.

DEVELOPMENT OF THE TELEPHONE FIELD.

The Central-office Equipment of a Successful Independent Telephone Company.

By H. P. Clausen.

The central-office equipment built for the Delmarvia Telephone company of Wilmington, Del., represents one of the most complete exchange systems yet constructed by a manufacturer not controlled by the American Bell Telephone company; and the writer much regrets that he is not at liberty to give a complete description of the system, especially of the specially designed circuits, which form a part of the installation. However, it is hoped that the following brief description will prove of some value to the exchange manager.

Inasmuch as the central-office equipment will receive the most consideration, no reference need be made to the outside construction work other than such as might render more clear certain functions of the exchange apparatus. The subscriber's station, it may be mentioned, is equipped with a 100-ohm magneto signal receiver and a magneto signal transmitter, which is wound so as to sound its own bell when operated through 10,000 ohms of resistance. The driving gear, of course, is provided with the usual automatic shunting arrangements, normally allowing the armature winding to remain shunted out.

FIG. 1. THE CENTRAL-OFFICE EQUIPMENT OF A SUCCESSFUL INDEPENDENT TELEPHONE COMPANY.—SWITCHBOARD.

The speech transmitter employed is of a type in which granulated carbon placed between two carbon electrodes serves as a variable resistance medium; it is connected in series with the primary winding of an induction coil and is fed by two cells of sal-ammoniac batteries.

The speech receiver is of the well-known horseshoe type, with a coil wound for 50 ohms placed on each of its poles. The coils are connected in series with the 75-ohm secondary winding of the induction coil.

Returning to the central office, we find that the switchboard is arranged with sufficient circuit capacity for allowing an increase to 1,500 subscribers' drops. The present switchboard, as it stands, is equipped only with 1,000 drops, but, as is shown in Fig. 1, the wood cabinet is provided with a blank space (at the left), which allows the installing of another 100-drop equipment, without necessitating the installing of additional cabinet capacity. However, when it is desirable to add 200 or 300 drops the wood cabinet must be extended beyond its present limits.

As already mentioned, the subscriber's station is equipped with a hand-driven magneto electric generator; therefore when the intending user desires to be placed in communication with another telephone station he attracts the central-office operator's attention by the application of a little energy in revolving the generator armature, which, in turn, generates an electric current that, on passing through the annunciator electro-magnet, tends to release a normally suspended shutter. The switchboard annunciator employed in the Delmarvia switchboard is of a type in which the indicating shutter is horizontally suspended directly before the metallic-circuit line spring-jack, the shutter when recording a call hanging before the line-jack in such a manner that the operator's plug cannot be inserted into the jack without restoring the shutter to its normally suspended position. This mechanical self-restoring feature is positive in its action, and obviates entirely the necessity of providing a complicated spring-jack, which is required with an electrically restored annunciator.

There are in the complete system 10 operators' positions, and each section is provided with a set of 12 circuit-changing keys, with the usual operator's microphone and receiving equipment.

The answering of a call is done in the following manner: When an operator inserts her answering plug into the calling subscriber's line-jack she depresses the circuit-changer lever. This act cuts her receiving circuit in parallel with both sides of the line. On receiving a response as to the caller's needs, the operator proceeds to insert the calling plug into the desired subscriber's line-jack, and, by imparting a slight forward movement to the circuit-changing lever, the local signal-current generator automatically connects its circuit to the tip and sleeve spring of the calling plug, and the same movement also disconnects the tip and sleeve spring of the answering circuit from that of the calling circuit. If this were not done, the calling current, passing in a derived circuit through the waiting subscriber's receiving telephone, would produce an unpleasant sensation; moreover, the telephone receiver would not long give an efficient service if the calling current were permitted to act upon it with every connection.

The statement is made that after learning the caller's needs the operator proceeds to insert the calling plug into the desired subscriber's jack. This is not strictly true. Virtually it is an act which the operator requests another operator to perform. Every calling-plug circuit belonging to a given operator is extended to every third operator's position throughout the entire system; therefore, supposing we have a 1,000-capacity switchboard and that the 100-drop sections are lettered A, B, C, D, E, F, G, H, I and J, the D operator would have each of her calling plugs duplicated at three other operators' positions; that is, the calling plugs are extended and so distributed throughout the system that any desired subscriber's jack may be reached from the D operator's position by means of the transfer circuits and order wires extended as shown (Fig. 2) to the A, G and J operators. As will be observed, the D operator may, with the local connecting plug, call any telephone station on either the C, D or E section, but if the desired station terminates in any other section of the system, it can be connected only by means of the extended calling-plug circuit.

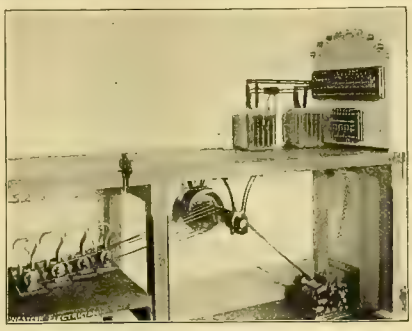


FIG. 3. THE CENTRAL-OFFICE EQUIPMENT OF A SUCCESSFUL INDEPENDENT TELEPHONE COMPANY.—STORAGE BATTERIES FOR TRANSMITTERS AND RELAYS.

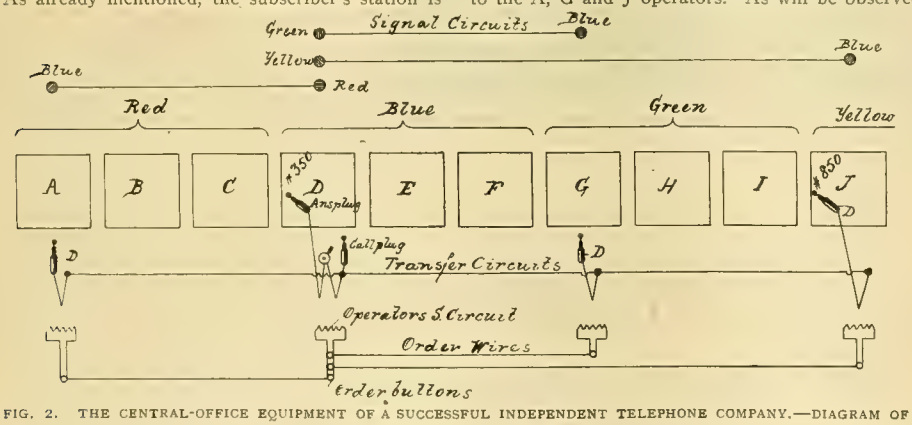


FIG. 2. THE CENTRAL-OFFICE EQUIPMENT OF A SUCCESSFUL INDEPENDENT TELEPHONE COMPANY.—DIAGRAM OF SWITCHBOARD CONNECTIONS.

The method of transferring outlined above is most fittingly named the multiple-plug system, and, as it depends on the theory of multipleing the calling instead of the called connections, it allows of a considerable saving in the first cost of equipping systems for serving 2,000 or 3,000 subscribers. In the multiple-plug system a transferred connection calls for the attention of one additional operator, whereas the multiple-jack switchboard requires but one operator to complete a connection. However, it must be admitted that when 1,500 subscribers can be successfully served by 15 operators, the multiple-plug plan certainly must possess features not thoroughly understood by the uninformed. As a rule the adverse criticisms have mostly been more or less based on an insufficient knowledge of the manner in which the contested points are being met.

As every calling plug of a given operator's set is terminated at every third section of the system, some means had to be provided for averting the possibility of a transferred connecting plug being forgotten and left in a subscriber's jack, even after the corresponding answering plug had been removed from the caller's jack, and the connecting plug ordered restored to its normal position. Such a condition of circuits would not necessarily result in "hanging up" the subscriber's circuit, for an incoming call would still be recorded by one of the clearing-out drops belonging to the operator's set from which the transfer connection originated, and if that particular set of local interconnecting cords happened to be idle when the call came in, no harm would result; but in case the originating operator, after ordering cleared a previously transferred connection, attempted to utilize the same interconnecting set for another connection, a calling current sent out over the calling plug would pass out over both the desired subscribers' lines, as also the subscriber's line previously ordered cleared. This, of course, would result in an endless confusion. However, such a condition cannot unintentionally be produced in the Delmarvia company's switchboard.

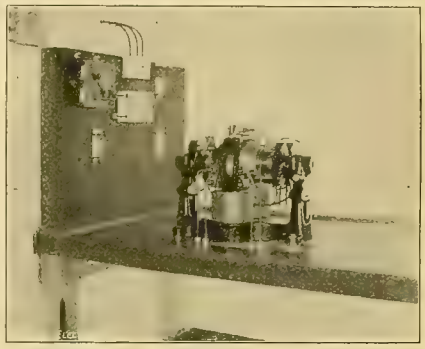


FIG. 4. THE CENTRAL-OFFICE EQUIPMENT OF A SUCCESSFUL INDEPENDENT TELEPHONE COMPANY.—MOTOR-GENERATOR FOR CHARGING STORAGE BATTERIES.

For the purpose of explaining the operation of the visual signaling system, we will divide the 10 sections of switchboard into four districts, as shown by Fig. 2. Though every 100-section is equipped with apparatus exactly similar in operation, we will select the D operator's position as a basis for our description. The answering plugs, 1 to 10 inclusive, when in their respective socket seats, normally tend to keep closed the circuit of a spring contact on which they rest. The calling plug of the local switchboard has no provisions for a spring contact, but the extended calling plugs at A, G and J each have a normally open spring contact, which, with the removal of a plug, immediately closes the relay circuit to which the corresponding answering plug on the D section normally forms a closed path. The D transfer system depends on the operation of three separately controlled relays, and their office is to open and close the circuit of three independent pairs of lamp signals.

As will be observed, the switchboards are divided into color districts; that is, the A, B and C district is red, D, E and F blue, G, H and I green, and the J district is yellow. The different colors are employed for the purpose of avoiding the confusion which is had when reference letters or figures are used. As mentioned before, there are two lamps to each signal circuit between the D operator and the A, G and J transfer operators. Following the general plan, the D operator would have three lamps as follows: First, red lamp from A; second, green lamp from G, and third, a yellow lamp from J. Now the A operator has but one blue lamp from D, as G and J have each a blue lamp also. Following the general description, it may easily be observed that the instant a green lamp lights upon the D switchboard the operator immediately recognizes the signal as originating at the G switchboard, and, vice versa, a red signal exposed on either section of the transfer switchboards at once indicates its source.

Bearing in mind the foregoing plan, we will assume that the operator D receives a signal on drop No. 350. Picking up, say, the No. 4 answering plug (which act opens the relay spring contact), she inserts the plug into the caller's jack, thus restoring the shutter, and, by depressing the circuit-changing lever, she learns that a communication is desired with the subscriber's station, No. 850. Pressing the order-wire button which connects with the receiver of the sixth operator to her right (J), she makes the following request, "4 D, No. 890." Even while mak-

ing the request for a connection, the D operator throws her circuit-changing lever over to a point for ringing out over the calling plug, which, of course, should test open, but the moment the J operator inserts the No 4 D plug into the jack No. 850, the buzzer in the D operator's generator circuit will sound, thus informing the D operator that the connection has been completed.

In case the D operator misunderstood the order and began to remove another plug than the one ordered, a checking signal would immediately have lighted up on both the originating and the transfer section, thus requiring the former operator to repeat the order and the latter to restore the wrongly removed plug to its socket, but if the No. 4 D plug

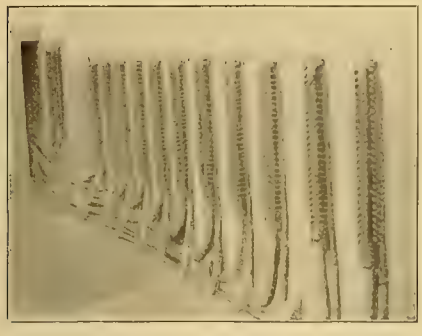


FIG. 5 THE CENTRAL-OFFICE EQUIPMENT OF A SUCCESSFUL INDEPENDENT TELEPHONE COMPANY.—CABLES ON BACK OF DISTRIBUTING BOARD.

had been removed as ordered, no lamp would have been lighted.

After inserting the extended calling plug into the No. 850 line-jack, the transfer operator has no means provided for allowing her to "cut in" on that particular circuit, and a request for connection with the line would be met with the usual "busy" response. On learning by testing that a conversation has been concluded, the originating operator restores the answering plug to its socket, which closes the relay circuit, and simultaneously lights a yellow and red signal lamp, located respectively on the D and J sections, thus automatically instructing the J operator to reseat the No. 4 D transfer plug, and giving the D operator a means for observing whether the instruction has been obeyed.

Another interesting departure of the Delmarvia

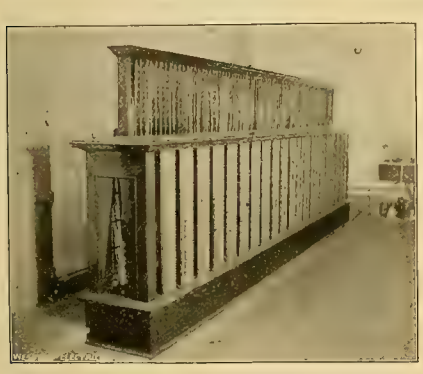


FIG 6. THE CENTRAL-OFFICE EQUIPMENT OF A SUCCESSFUL INDEPENDENT TELEPHONE COMPANY.—DISTRIBUTING BOARD.

system is the method adopted for enabling the chief operator to constantly observe the amount of work done by the operators under her charge, and also their promptness in answering incoming calls. The annunciator shutter of every line drop is arranged with a normally open contact spring, which connects with a relay circuit common to every individual 100-drop section, and when an incoming call releases the shutter the relay circuit is completed, with the result that a white pilot lamp placed before the operator lights up at the same instant with a corresponding lamp located on the chief operator's desk. Therefore, if for any reason an operator fails to quickly answer a recorded call, it is at once perceived and investigated by the chief operator.

The chief operator's desk is also equipped with order buttons, trunk jacks, an operator's distributing board and a number of specially designed appliances common to such equipments. The order buttons are provided for the purpose of allowing the chief to "cut in" and listen to any conversation that the operators may be engaged in. The trunk jacks are terminals connecting to a square set of interconnecting cords and circuit-changing keys placed alongside of every regular operator's equipment. The trunk-circuits are employed whenever the chief operator desires to be connected with a subscriber's circuit for the purpose of communication or test, as the circumstances might demand. Owing to the fact that a satisfactory operation of the system depends on every transferred connection receiving immediate attention, and inasmuch as every operator is at intervals virtually a transfer operator, it was considered essential to arrange the chief operator's distributing board, which is operated as follows: If the G operator desires to leave her station temporarily, she asks the chief's permission for so doing, and, on giving a permission, the chief operator plugs the G operator's order-receiving wire over and into connection with either the F or H operator's circuit. Therefore, any orders made on the G order wire will be attended by the operator to whom the order wire has been transferred.

The transmitters and relays are supplied with current by two cells of storage batteries, which are so connected that while one cell is being discharged the remaining cell may be left in the charging circuit. Fig. 3 indicates the manner in which the batteries have been set in relation to the transmitter and relay switches. Fig. 4 shows the motor-generator which supplies the charging current for the storage batteries and also the alternating current required for operating the subscribers' bells. The primary side of the motor-generator is wound for 220 volts and the secondaries are wound for giving two currents—an alternating current at 75 volts and a direct current at eight volts. The eight-volt circuit, which is used for charging the storage batteries, is equipped with an automatic cut-out which opens the charging circuit whenever the primary-current supply is discontinued. The primary circuit is also equipped with an automatic cut-out arrangement, as is shown in Fig. 4 to the left of the machine.

The apparatus shown below the table in Fig. 3 is used for supplying the alternating current for

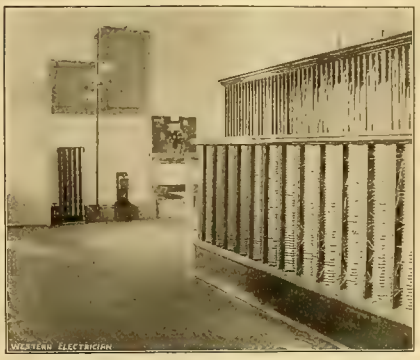


FIG. 7. THE CENTRAL-OFFICE EQUIPMENT OF A SUCCESSFUL INDEPENDENT TELEPHONE COMPANY.—DISTRIBUTING BOARD.

ringing the subscribers' bells whenever the motor-generator is temporarily cut off.

Regarding the distribution of the wires which connect the switchboard with the underground cable-heads, it may be said that the problem has been well met. The underground cables, it will be observed (Fig. 5), enter the distributing room through an opening in the vault at the left and connect to the cable-heads, which in turn are connected to the distributing board by means of the somewhat smaller cables shown to the right of every cable-head. Referring to Fig. 6, we have a view of the switchboard or test side of the distributing board. The wires coming from the cable-heads are connected to the opposite side of the board, where are also placed the strong current arresters and fusible cut-outs. The two sets of terminals are connected together by means of "jumper" wires threaded through the distributing frame in such a manner as to avoid all crossing of the wires. Fig. 7 shows a somewhat larger view of the board. It represents a 300-line section and is four feet 4½ inches long, that is 17½ inches per 100 metallic-circuit lines.

Independent Telephone Manufacturing Interests in Chicago.

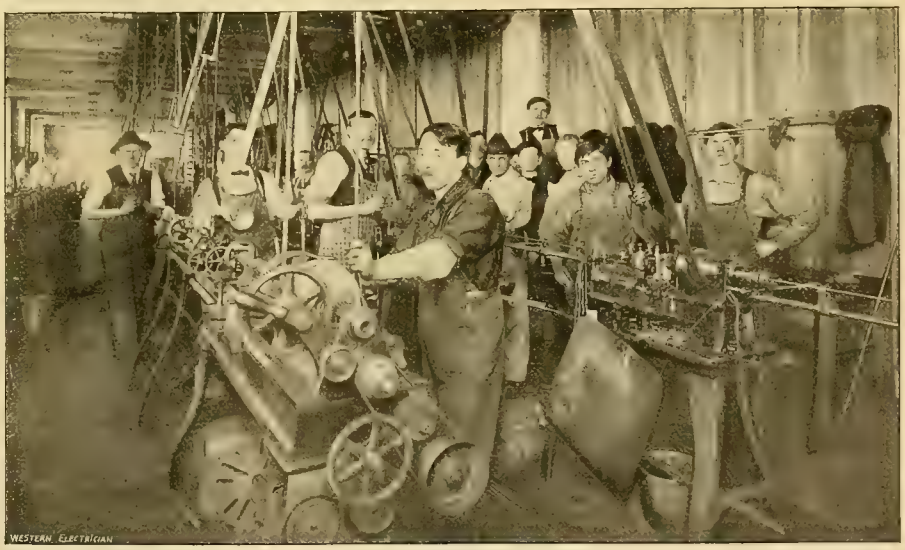
The Independent Telephone association could have selected no more appropriate place in which to hold its convention than Chicago, as this city is the center of the most important field that is being developed by the anti-Bell companies and is the home of the largest manufacturing interests identified with the independent movement. There are four large establishments in this city whose output is larger than the combined product of the four largest independent telephone manufacturing companies of the country outside of Chicago. This fact of itself shows the importance of this section of the country to the independent movement. There are, of course, many other establishments in Chicago which would be considered large plants in any other place, but their relative importance is diminished by comparison with their neighbors.

Since the independent movement was started those engaged in the manufacture of telephone apparatus have made remarkable progress, not only in the number of instruments turned out, but in the quality and character of the equipments. There have been marked improvements in the design and workmanship as well as the material entering into the construction of switchboards transmitters, receivers and fittings, and it is of course acknowledged that the experience gained in line construction has raised the standard of service materially.

While all these improvements have been going on the development and expansion of the business have progressed far beyond the expectation of the pioneers in the movement. It would be impossible to make a fair estimate of the amount of money invested, the number of equipments installed or the number of subscribers now being served by the independent companies of the country, but some idea may be gained of the present condition of the industry in Chicago from a perusal of the appended sketches of representative manufacturing companies and an examination of the illustrations presenting views of the leading factories of the city.

American Electric Telephone Company.—Two views in this company's large factory at 171-173 South Canal street, Chicago, are presented herewith. The American company is one of the most important in the independent telephone manufacturing field, and claims that over 100,000 of its instruments are in use in 500 exchanges. The president of the company, Mr. P. C. Burns, is one of the best known men in the business. One of the largest of the exchanges installed by this company is that at Kalamazoo, Mich.

It is safe to say that there are many people who



AMERICAN ELECTRIC TELEPHONE COMPANY.—FACTORY SCENE.

hear of the American Electric Telephone company through its large number of salesmen who do not realize the full extent of the business done by this prosperous institution. President P. C. Burns recently gave the information that the company has now employed in its Chicago factory as many as 150 hands and indirectly in Cleveland as many as 80 hands, and there are at present in active work on the road eight traveling salesmen. Roughly estimating, the company turns out on an average 100 telephones and 150 drop switchboards a day, to say nothing of a large volume of miscellaneous appliances employed in telephony. It is claimed by the management of the American Electric Telephone

company that its present business is so large that were it investigated and comparisons made, the result could not fail to be a surprise to many, even to the "knowing ones."

Stromberg-Carlson Telephone Manufacturing Company.—The offices and factory of this company occupy the second and fifth floors of the Dunn building, Jackson boulevard and Clinton street, Chicago. On the second floor are the offices and back of them the main factory, but the switchboard assembling room and testing department are on the fifth floor. One of the cuts shows the main part of the machinery department as seen from the door leading from the offices. Here the receiver heads, generator armatures and fields and all cast parts are turned down and milled into proper shape on the lathes and heavy milling machines. The generator armatures and coils, when fitted, are taken to the winding room, where they are first well insulated and then wound with silk-covered magnet wire of proper size, on power winding machines attended by experienced winders. The coils are then covered and thoroughly tested before returning to the stock room, to be held for the assembling department. The magnets, after the steel is cut to proper length in the machine shop, are bent into proper shape and tempered in the blacksmith shop. The transmitter cases and all parts made from sheet metal are punched out and formed with special dies. All of the special screws, binding-posts, etc., are here made from the rough rod on the most improved screw machines. When the brass parts are in readiness they are sent to the nickel-plating room, where they are smoothly polished on emery and walrus-hide wheels, etc., and then heavily plated and buffed. After all the parts have been completed they are turned over to the assembling department, where they are then put together, each man or group of men having a particular part to make. The instruments are then held subject to orders, when they are thoroughly tested and accurately adjusted according to the requirements of the system they are contemplated for. All the switchboard parts, after having been formed in the machine department and plated, etc., are sent to the switchboard department, shown in the cut, where they are then assembled, wired and tested in detail. After the instruments are completed they are transferred to the shipping room, where they are neatly packed and applied to their proper orders and shipped. The factory and offices are equipped with their own electric-light plant, using a 200-light C. & C. machine. The numerous departments are connected with an S.-C. intercommunicating telephone system.

The entire plant is run systematically, every part of the apparatus being made under the direct supervision of the company, while the greatest care is taken that the most detailed part is the very best possible production.

AMERICAN ELECTRIC TELEPHONE COMPANY.—VIEW IN THE FACTORY.

Western Telephone Construction Company.—This corporation was organized in March, 1893, as a result of the efforts of James E. Keelyn, the original promoter, who for two years prior to its organization was actively engaged in securing control of valuable telephone patents, franchises and rights of way, and arranging for the manufacture of apparatus. This foresight on Mr. Keelyn's part placed the new concern in a position to furnish telephone equipments that would enable the users to enter the telephone field in competition to the American Bell Telephone company. In 1892 the details of a plan were formulated and adopted by Mr. Keelyn and H. C. Dodge, the present general superintendent of the company, which met with the approval of conservative and influential business men wherever presented. It provided for the organization of independent telephone-exchange companies, and so successfully was it carried out that the movement spread with rapidity in all sections of the country. The system of promoting the work was carried on along the following lines: First, lists of subscribers to the new telephone service were procured at desirable points for a term of from three to five years, then franchises were obtained and stock subscriptions solicited from local business men, whose identification with the new concern would tend to strongly entrench it. Information was furnished upon the cost of constructing exchange systems, the cost of operation, maintenance and depreciation, etc., based upon accurate knowledge of these matters gained from experience with Bell interests. Indefatigable work in this direction resulted in enlightening the citizens at numerous points concerning the possibilities for the investment of capital in the anti-Bell companies with certainty of handsome returns, at rates for service much less than those charged by the monopoly, and the awakening in subscribers of widespread interest in the benefits to be derived from the use of apparatus furnished by the independent manufacturers. Naturally a large demand was created for apparatus manufactured by the Western Telephone Construction company from the beginning of its organization. The company from the start has been continually increasing its facilities for the manufacture of high-grade apparatus, and it is a remarkable fact that the records show that never at any time in its history has the advancement been so rapid as during the last two or three months. In that time large additional factory space has been provided for, and several thousand dollars invested in new and improved machinery. The company occupies the greater part of the building in which its factory is situated. A view of one of the principal floors is presented in the illustration on the next page. Each department is under the supervision of a competent head, and facilities are at hand to turn out high-grade apparatus adapted to meet the acquirements of any special service demanded. The Western apparatus is in use in upwards of 1,000 exchanges and toll-line systems in the United States alone. Among special orders of recent date is one calling for special toll-line station equipment from the Wisconsin Valley Telephone company for use at its junction stations, connected by over 2,000 miles of copper metallic circuits. The largest contract of the present year, for exchange equipment, was received from the Newark Telephone company of Newark, N. J., calling for a 2,000-line multiple-transfer switchboard for the Newark main central exchange, which with branch city exchanges, including the Bellemont, Belleville, Roseville and Ferry street offices, comprises a total capacity of upward of 3,100 lines, and will make this exchange the largest independent telephone exchange in full operation in the United States.

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY.—A FACTORY GLIMPSE.

STROMBERG CARLSON TELEPHONE MANUFACTURING COMPANY.—SWITCHBOARD WORK.

Sterling Electric Company.—The factory of this company is located at 71-73 West Adams street, and is conceded to be an important addition to the independent telephone industry. The company was incorporated on February 25th for the purpose of manufacturing telephone switchboards, distributing boards, inside cable terminals, pole-top cable terminals and a protective system. The business affairs of the company are taken care of by Frank B. Cook, vice-president and chief engineer, and W. E. Doolittle, secretary and general manager. The goods manufactured by this company are practically the same as those in use by the Bell company in modern exchanges. The Sterling company is enabled to do this by reason of being licensed to manufacture under the patents of its engineer, Frank B. Cook, who, while serving in the capacity of chief electrical engineer for the Central Union Telephone company, invented, perfected and patented the devices which the Bell company is using, and which he licenses the Sterling Electric company to use as well. The Sterling company's apparatus includes its standard switchboard, made in sections of 100 drops, a distributing board, mounted in a handsome cabinet

to the right or to the left of the switchboard proper, and the combined cable terminal and protector, the subscriber's station protector, and the line fuse, comprising the company's complete protective system. This system has the indorsement and approval of the National Board of Fire Underwriters. The pole-top cable terminal is practically a hermetically sealed outside end for cables, needing neither platform nor boxing. With this class of apparatus within reach independent telephone users are placed upon an equal footing with the Bell company to give identically the same service, and with the advantage of public opinion favorable to the independent companies, it would seem that the independent field is destined to experience a large, substantial and increased growth throughout the country before the end of the year.

STERLING ELECTRIC COMPANY.—MAIN ROOM IN FACTORY.

Independent Telephone Movement in Indiana.

By George W. Beers.

Much has been accomplished by the independent movement in the way of extending the usefulness of the telephone in Indiana during the last four years. Instead of the 40 exchanges, with about 6,000 subscribers, and practically no toll-line service, which comprised the telephone system of Indiana at the expiration of the underlying patents, we now have 137 exchanges, with about 20,000 subscribers, and not less than 5,000 miles of inter-town lines.

The greatest single achievement has been the obtaining of a franchise and the commencement of construction by the New Telephone company in Indianapolis. It has frequently been asserted by the old concerns and conceded by the independent people everywhere, that Indianapolis would be the "Atlanta" of the Bell defense, and, now that their "Atlanta" has fallen, it is suggested that their "Appomattox" is not far off.

The New Telephone company of Indianapolis is the most robust infant yet born to the independent telephone family. It is in the hands of capable men of ample means, and its career thus far is an evidence of what may be expected of it. In the face of the most violent opposition it has secured over 3,000 five-year contracts, overcome all opposition before the Board of Public Works and City Council and succeeded in securing a fair, intelligently drawn franchise for 25 years, with provisions for renewal for a like term. It is laying conduits in a district much more extensive than required by its franchise, and has further demonstrated its permanency by the purchase of a plot of ground in the business center of the city, upon which it is erecting its own building for exchange purposes and offices. It will be the first of the independent companies, and one of the few exchanges in the United States, occupying its own premises.

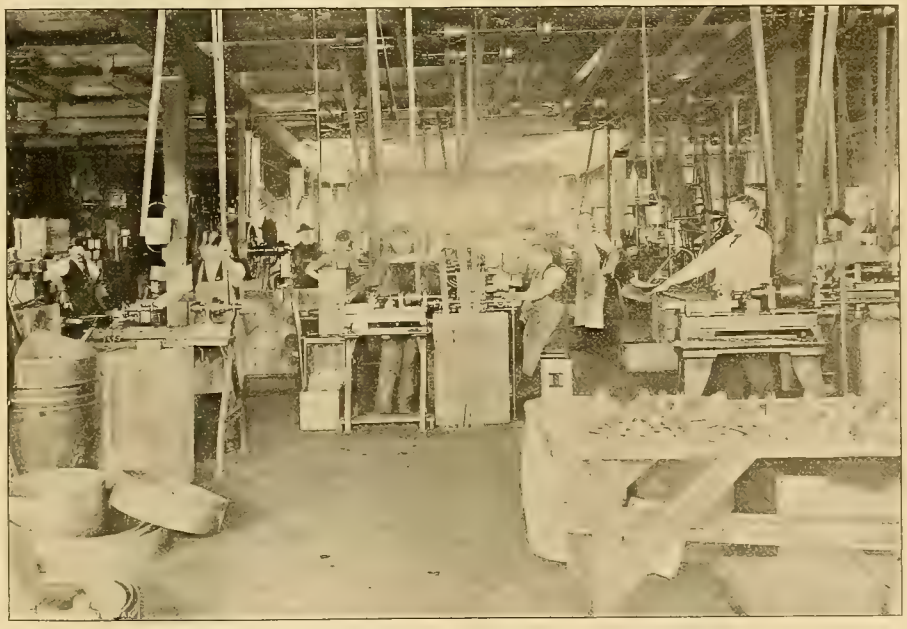
The time for experimenting with cheap construction and inferior apparatus has passed, and the independent plants of to-day in Indiana are employing materials of quality, and performing their work in a manner, not excelled anywhere in the world. This fact is emphasized by the underground construction in Fort Wayne and South Bend, where the independent telephone companies employ the only underground construction in the state outside of Indianapolis.

Practically the same gentlemen who own and control the Indianapolis company have organized the New Long-distance Telephone company of Indiana. This corporation has a capital of $1,000,000 and is under contract to build 1,000 miles of lines north, south, east and west from Indianapolis, connecting through the capital all the existing toll-line systems. Extensions will be made until every subscriber for an independent telephone can be connected with every other subscriber within the state, thereby enabling each exchange to furnish its patrons with a service much more important than any heretofore existing and of far greater value than it contracted to give.

The use of the toll lines, as they now exist, covering only limited areas, has far exceeded the rosiest estimates of the most optimistic of promoters. What, then, shall we say of the patronage which will be attracted to the lines of a system bringing within speaking distance all the inhabitants of a great state, whereby their business may be transacted, and, in a measure, their social functions discharged? It seems to me that the future of this long-distance movement is destined to occupy a position in the commercial life of the state excelled by no other interest.

This long-distance service must be equal to any of its kind. In order to accomplish such results, only construction of the most substantial character and materials and apparatus of the highest quality will be employed by the New Long-distance Telephone company, and it is expected that a general plan relative to materials, apparatus and construction will be adopted by connecting lines, with a view to uniformity, solidity and excellence of service.

The real use of the telephone in the United States did not commence until the expiration of the original telephone patents. Up to that time the field hand been only partially occupied. The first new plant in the state of Indiana, with 40 instruments, was erected in 1894 by the writer at Decatur. That exchange has now grown to nearly 200 subscribers. Its success was so marked that in the four years intervening 137 exchanges have been erected, comprising all of the county seats, as well as the important towns within the state, and during this year the movement will culminate with the installation of a large exchange in the capital city and the connection of all the exchanges in one vast state system.



WESTERN TELEPHONE CONSTRUCTION COMPANY.—MAIN ROOM IN FACTORY.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Northwestern Telephone Exchange company held it annual meeting in Minneapolis last week and re-elected the old board of officers. The capital stock was increased $1,000,000. The stockholders have agreed to take and pay for the new stock in ratio to their holdings as rapidly as the company requires funds for extensions. The toll-line system is to be extended to all the principal cities of Minnesota, North and South Dakota. The Minneapolis office has just moved its exchange to the new building at Third avenue South and Fifth street. The removal completes the improvements which have been in progress in Minneapolis for a year and a half, and which cost $300,000. It is now unnecessary to ring the bell to get "Central." Taking down the receiver notifies her by a small lamp on the switchboard becoming alight.

The Cedar Valley Telephone company is installing an exchange in Traer, Ia. This company will probably locate an exchange in Dysart also.

The aldermen of Dubuque, Ia., voted to give each alderman a free telephone. One of them, John Flynn, by name, decided that, since he has one in the office which he does pay for, his constituents shall have the use of the new one. He has therefor asked the mayor to have the instrument placed on a telegraph pole at the corner of Sixteenth and Iowa streets, where the taxpayers, who will have to pay the rental, can have access to it. The mayor has declined to enter into contract with the telephone company for the instruments.

The Iowa Telephone company will construct a telephone exchange at Nevada, Ia., at once.

The Iowa Telephone company will build a toll line from Mount Pleasant, Ia., to connect with Swedesburg, Olds, Wayland and Winfield.

The Mississippi Valley Telephone company will soon have its exchange in working order in Fort Madison, Ia.

The Kendallville and Cresco Farmers' Telephone company has been incorporated at Cresco, Ia., with $360 capital stock.

The Southern Dakota Telephone company is preparing to build a toll line from Garretson, S. D., to Dell Rapids.

The town of Dysart, Ia., has granted a franchise to the Iowa Telephone company for an exchange.

There is considerable complaint at Cresco, Ia., over the way that the Standard Telephone company mutilated shade trees.

The Wisconsin Telephone company has about completed its long-distance system in Wisconsin, and can now talk with all parts of the state over its own wires. The company has just established a new exchange at Stanley, Wis., which is flourishing. The Sunset Telephone and Telegraph company is preparing to place its wires in Seattle, Wash., underground. The work will cost about $50,000, and it is expected to take about eight months.

It has been reported the Mississippi Valley Telephone company had withdrawn from Minneapolis, but the report is denied. The company has laid a

[*Continued on page 8.*]

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The use of the Röntgen rays in military surgery has risen to the dignity of a parliamentary inquiry in England. The question came up last month in the House of Commons, when General Russell asked the government what, if any, provision had been made for X-ray surgical examinations in the British army. Mr. Brodrick, in answer, stated that the Röntgen-ray apparatus is very difficult to adapt for field service, and was not carried with the field army in the recent operations. From the returns the medical authorities do not consider that there was a single case in which life could have been saved by the use of the apparatus. Two sets are now in Egypt, and one more will be sent out shortly. Two have been adapted as far as possible for field service, and one is for use in the base hospital. Sir J. Fergusson asked whether 400 men were not wounded by bullets, and whether the apparatus would not have been useful in locating the bullets. To this Mr. Brodrick answered that the senior medical officer had gone carefully into the cases, and had been unable to trace any single case in which the apparatus would have been specially useful, or in which an operation would have been carried out more successfully by the use of the apparatus.

Electric-lighting companies seem to be quite generally readjusting their rates on a more intelligent system of securing proportionate pay from the plant investment placed at the disposal of each customer. The subject of rates to customers and its antecedent, the proper way of determining the cost price of a unit of electricity, were given a great deal of attention at the recent convention of the National Electric Light association. There is no doubt that the flat-rate system, and, to a less extent, the meter system, of charging, are crude and unscientific. The cost of making a unit of electricity varies at different times in the day, and for different customers, and theoretically the price should vary with it. The load-factors of all customers, small and large, are now studied more closely by central-station managers, and it is possible to prepare tables of rates based on exact data. How far it is advisable to carry into practice what may be termed the scientific method of charging, is a question that must receive careful attention in each individual case, and to which no universal rule will apply. Customers' prejudices, questions of policy and other considerations will influence the decision, so that the ideal exact discriminating method will probably never be fully attained by any company in practice. However, it is plainly evident that considerable improvement will result from the present agitation of the subject.

It is rather curious that while in both steam-railroad operation and electric lighting the United States is at least abreast of any other nation in the development of its plants, in the one item of electric-train lighting we seem to be far behind the railroad systems of Europe. A recent writer states that there must be over 6,000 railroad cars in Europe equipped for electric light, the number having increased from the 2,000 of 1896. If these figures are correct—and the authority for them is Dr. M. Buettner, a German storage-battery man, who, in the Railroad Gazette, gives quite a list of railroads in Denmark, Switzerland, Norway, Sweden, Germany, Austria and Hungary having electrically lighted cars—our railroads certainly compare very unfavorably with those of Europe in the extension of this improvement, for the number of steam-railroad cars in this country similarly equipped must be less than 1,000 rather than over it. Two reasons may account for this situation—the fairly good quality of the illumination furnished by the Pintsch compressed-gas system and the backward state of the art of storage-battery application in this country. The latter reason is rapidly disappearing, and indeed never had more than an indirect retarding effect, as we have electrically lighted trains without storage batteries. The principal cause for the deliberation of the railroad companies is, undoubtedly, the fact that the traveling public has made no serious complaint of the light furnished. Either the older methods of train lighting abroad are worse than ours, or else American travelers are more complaisant.

Serious concern continues to be manifested by the English press at the very evident danger of cable-cutting, to which the world-wide British empire is exposed in time of war. The existing war shows that the interruption of cable communication is an effective method of warfare, and while the American cable-cutting attempts have not always been successful, still, as the net result of the operations, the enemy has been seriously crippled. An English contemporary puts the British situation in a nutshell: "We would again strongly insist on the danger to which the cables connecting England with Gibraltar, Malta, West Africa, The Cape, Zanzibar, Mauritius, Egypt, India, the Straits Settlements, China, Australia and New Zealand are exposed. If we except continental land lines, and also an impracticable route via America, the West Indies the South American republics and Brazil, we are utterly and entirely dependent for communication with the colonies above-named, on a single group of three cables, which, starting from Cornwall, run southward to landing places in Spain and Portugal, all lying for a distance of about 150 miles from England in water which is not 100 fathoms in depth. These cables lie within easy reach of the French naval headquarters at Brest, and however efficiently the mouth of the channel might be patrolled by English war vessels, the risk of interruption, and the disastrous consequences which such interruptions would entail, are much too serious to be any longer regarded with levity." Various protective measures are discussed, but none of them seems entirely practicable. For one thing, the need of naval cable-repair ships seems obvious.

In the matter of nomenclature, the words "telegraphy across space," which some of our contemporaries insist upon in the interest of accuracy, in place of the more common "wireless telegraphy," are of rather doubtful utility. They express the idea with exactness, but at the cost of another word. "Wireless telegraphy" is inaccurate, as short wires are employed, although not in the manner in which ordinary telegraph wires are used. Still it conveys the main idea that no direct wires are used to conduct the electrical signals from the sender to the receiver. What is needed, however, is a new word for the new art.

This brings again to mind the somewhat unsatisfactory relations of the art of expression and the industrial arts as lately developed. For instance, what is the authoritative term to employ in speaking of a self-propelled vehicle? We hear of motocycles, of autocars, of horseless carriages, of automobiles, of motor carriages and of automotor wagons. None of these terms seems entirely satisfactory, and some of them are ridiculous. Where shall we turn for the right word? Again, it does not seem to be settled whether a newly made word is spelled sciagraph or skiagraph. Then there is the large number of words that have been ground out, principally by showmen, to stand for some exhibition of the moving-picture idea. Edison was first with "kinetograph," but one doesn't hear much of that word at present.

All of which goes to show that there should be a Bureau for Establishing and Standardizing Scientific, Technical and Geographical Names. Such an institute should be of respected personnel and undisputed authority. It should be an international affair for all English-speaking peoples—a form of Anglo-American alliance that would not excite a breath of protest.

It is strange that such presumably active and enterprising communities as those making up the Australian colonies should be backward in taking advantage of the economies and conveniences of the varied electrical applications of modern life. That such is the case, however, must be believed on the testimony of no less a person than the late president of the Electrical Association of New South Wales. This gentleman, Mr. James O. Callender, on retiring from office last March, followed the world-wide custom of making a presidential address. He reviewed the electrical progress of the year in different parts of the world and then said:

Turning now to Australia, and looking back over the period that has elapsed since the last presidential address, we cannot congratulate ourselves on any great progress. There has not been that large development in electrical engineering that we have looked forward to, and the stigma that has so long attached to Australia as the least advanced of all civilized countries in electrical engineering still remains, although it is pleasing to record that there are signs of the apathy which has reigned so long breaking up.

This is puzzling. Here in the United States we have been disposed to regard the Australians as combining, in some degree, British thoroughness with American enterprise; and there seems to be no good reason why they must accept the stigma of being "the least advanced of all civilized countries in electrical engineering." Other British colonies, as Canada and South Africa, are well up to date in the industrial applications of electricity. Japan, the neighbor of the island-continent in the Pacific, is wide-awake electrically. What's the matter with Australia? Perhaps the financial troubles a few years ago may have something to do with this case of arrested development, but this can only be accepted as a partial explanation at best. Whatever the cause, Australia should shake off its apathy in electrical matters. In this day and generation the extent of the use of electricity in every-day affairs is accepted as an almost exact indication of a nation's progressiveness. Our Australian friends should not form the rear guard in the march of advancement.

WAR NEWS.

Cable Communication.—Direct telegraphic communication between Washington and the scene of the American naval and military operations in eastern Cuba has been established, and messages are now exchanged with rapidity and accuracy. The first military cable was established by the Signal Corps, under Lieutenant-Colonel Allen, at Playa del Este, a small place directly on the coast and about 15 miles east of Santiago. The change was made from Camp McCalla in Guantanamo Bay, where the cable was originally cut, to Playa del Este, in order that the station might be nearer the scene of action. Colonel Allen, who is in charge of this work, was a captain in the regular army at the time the present war broke out and is an expert telegrapher. When a young man he was employed in a telegraph office at South Bend, Ind., the home of the late Schuyler Colfax when he was speaker of the House of Representatives. Mr. Colfax often had occasion to notice the intelligence and industry of the young man, who was enterprising and ambitious. In 1868 a vacancy occurred at West Point subject to his appointment, and he sent young Allen to the military academy, from which he graduated in 1872. He was appointed a second lieutenant in the Third Cavalry, and saw much service in the Southwest during the Indian wars. When the Signal Service was organized Colonel Allen was transferred to that service, and became the senior captain in the corps. General Shafter made the special request that Colonel Allen be assigned to his staff. Colonel Allen speaks Spanish, is an expert telegrapher and understands naval and military signaling.

A late dispatch from Colonel Allen to General Greely stated that he was about to extend his line of telegraphic communication westward from Playa del Este to Aguadores, which is only a half-dozen miles east of Morro Castle and very much nearer the advance of the American army. This will be done by a shore cable which already exists between the two points. A field telegraphic service has already been dispatched from Tampa, so that in the course of a few days at most General Shafter will have a telegraphic instrument in his own tent, putting him in direct communication with Washington. The little band of signal-corps men has been doing some of the most energetic and exhausting work of the campaign. The cable operator are also deserving of the greatest praise. There are only two at the cable terminus, which means turns of 12 hours each of the hardest kind of work under the most trying conditions of weather. General Greely already has taken steps to have them assisted by other operators.

It is now admitted that one of the cables connecting Santiago and Jamaica is still intact and in working order. General Greely, the chief signal officer of the army, is not relaxing his efforts to cut that last link. For several weeks it has been known that this cable was in working order, and the St. Louis has been trying desperately to cut it. In addition, the cable steamer Mancel is to be assigned to the task. The difficulties in the way of accomplishing this are great. The Kingston cable was laid fully 20 years ago and has become covered with barnacles and marine deposits until its original size has been increased to that of a man's arm. In addition it is completely covered with silt and seaweed, so that it is almost impossible for the ordinary grappling irons used by steamers to catch hold of it unless they should strike the cable at some point where it hung over a depression in the bottom. Even when caught in the grappling irons the cable is of such a weight, owing to the marine deposits upon its surface, that it would be almost beyond the power of any lifting apparatus on board an ordinary ship to hoist it to the surface from the vast depths in which it lies. On the south coast of Cuba, within a mile of shore, the bottom pitches suddenly downward to the depth of more than a mile, and it is exceedingly difficult to pick up a cable in such water. Probably it will be much easier to reach this Santiago-Kingston cable after the batteries and forts lining the harbor entrance and just above have been reduced, for then the cable-cutting boat will be able to go into shoal waters, from which it is now excluded.

The following interesting paragraph appears in the London Electrician: "With reference to the statement made in the daily press—that if the United States interrupt telegraphic communication with Spanish colonies Spain will retaliate by severing the cables between the United States and Europe—we desire again to point out in the strongest manner the futility of such an attempt, which would only result in injury to neutral property without effecting the desired object, and would inevitably lead to heavy claims for damages. To say nothing about the practical impossibility of breaking some 12 or 13 cables before those first severed are repaired, we have it on the authority of one of the Atlantic companies that they have transmitted readable code words through a cable 500 miles long, broken about midway, by means of apparatus invented by Mr. A. C. Brown of the Single Wire Multiple Telephone Signal company."

Searchlights.—In a recent article in Cassier's Magazine Lieut. R. C. Smith of the United States navy argues that the battleship cannot implicitly rely on its searchlights to detect torpedo-boats in time to sink them in case of night attack. He cites some interesting figures. In 26 different exercises that have taken place between the torpedo-boats stationed at the United States torpedo station and searchlights ashore, or in ships of the navy afloat, the average distance of discovery by the aid of the light was 781 yards, the greatest distance 2,000 yards, and the least practically zero, the boat having got alongside the ship without discovery. The weather during these exercises was generally good, never with any appreciable fog or mist, and occasionally with a full moon. Other sets of figures were obtained by causing the boats to run out under the searchlight to the limit of visibility. The distances under these circumstances varied from 1,000 to 2,750 yards. The difference is due to the great difficulty of picking up a small neutral-tinted object by a sweeping beam. "Now," says Lieutenant Smith, "taking the average distance of discovery, as above stated, at 781 yards, in order to reach torpedo range of 500 yards, the boat must cross a zone of 281 yards, which at the moderate torpedo-boat speed of 20 knots, would require 25 seconds. Is this sufficient to put the boat out of action? If not, the chances of a single boat against a single ship depending only on searchlights would be more than one-half. With several boats, making a preconcerted attack, the chances of the ship would be correspondingly less."

C. F. Annett, Jr., in the Navy.—Chicago's electrical contingent in the army and navy is fast assuming very respectable proportions. Among the young men who left Chicago with the naval reserves is the electrician whose portrait is given this week. This is C. F. Annett, Jr., a former employe of the Western Electric company and more recently engaged as one of the electricians of the Illinois Central Railroad company. Young Mr. Annett enlisted in the naval militia some time ago and he is now serving in Cuban waters on the battleship Oregon, the

C. F. ANNETT, JR.

man-of-war that recently made the fine run from San Francisco to Florida. Mr. Annett is the son of Charles F. Annett, the assistant superintendent of telegraphs for the Illinois Central Railroad company, and he is highly esteemed by his associates.

Miscellaneous Notes.—The United States ship Vulcan, formerly the passenger steamer Chatham, the floating shipbuilding and repairing plant, has left Boston for Cuban waters. The vessel contains tools to build every part of a naval ship and its electrical equipment and to manufacture small rapid-fire guns. Its outfit is valued at more than $300,000, and it is officered and manned by some of the best-known shipbuilding experts in this country. Her captain, Lieutenant-Commander Ira Harris, is thoroughly conversant with naval machinery.

The first detachment of the New York regiment of Volunteer Engineers is in camp at Peekskill, N. Y.

A second call for additional telegraph operators for the Volunteer Signal Corps has been issued. The recruiting in and about New York for the requisite number will be carried on at the Second Signal Corps armory, at No. 801 Dean street, Brooklyn.

Parts of two companies of the Second Battalion of the Second Regiment of Volunteer Engineers have been recruited in Chicago and have been sent to Fort Sheridan, the rendezvous of the First and Second battalions of the regiment.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until July 13th for an addition to the electric plant at the Mare Island (Cal.) navy yard. The following items will be needed in the installation: One 100-kilowatt dynamo and four 30 horse power stationary dynamos; one 15 horse power stationary motor, one switchboard, 300 feet wire cable, 500 feet wire cable, 350 wire cable, 50 feet copper wire. Intending bidders desiring specifications and blank forms of proposals can obtain them upon application to Edwin Stewart, paymaster-general, U. S. navy, Washington, D. C., or to the commandant of the navy yard or to the Navy Pay Office at San Francisco, Cal.

American Institute of Electrical Engineers.

(Special Correspondence of the Western Electrician.)

Omaha, June 29.—This is probably the most important week of the season for the electrical department of the Omaha Exposition, as the American Institute of Electrical Engineers is holding its fifteenth general meeting in the exposition city. The attendance of eastern members did not come up to the expectation of the management, but the delegation was a fairly representative body and was large enough to make a good showing when the opening meeting was called to order. The eastern contingent was met at the train on Monday morning by the local committee on arrangements, comprising the following-named gentlemen:

J. J. Dickey, chairman, Andrew Rosewater, L. H. Korty, S. J. White, Frank Murphy, W. S. Dimmock, C. O. Fuller, Luther Drake, Israel Lovett, C. L. Yost, H. Vance Lane, J. A. Nash, E. F. Shurig, A. S. Rogers, W. W. Umsted, Henry Rustin, Hon. J. A. Creighton and Prof. R. B. Owens.

Following is a list of the names of the gentlemen in attendance at the meetings:

Abbott, Arthur Vaughn	Chicago.
Armstrong, A. H.	Schenectady.
Arnold, Bion J.	Chicago.
Badt, F. B.	Chicago.
Berg, Ernst J.	Schenectady.
Bingham, W. W.	Omaha.
Burgess, Charles F.	Madison.
Creighton, Hon. J. A.	Omaha.
Crocker, Francis B.	New York.
Damon, George A.	Chicago.
Dickey, J. J.	Omaha.
Dimmock, W. S.	Omaha.
Drake, Luther	Omaha.
Eddy, Dr. H. T.	Minneapolis.
Ekstrom, Axel	Schenectady.
Frankenfield, Budd	State College, Pa.
Fuller, C. O.	Omaha.
Goldsborough, W. E.	Lafayette, Ind.
Hamerschlag, Mr.	New York.
Harris, G. H.	Birmingham, Ala.
Hibbard, Freeman	Minneapolis.
Horton, C. B.	Omaha.
Howell, John W.	Newark.
Humphrey, H. H.	St. Louis.
Jackson, D. C.	Madison, Wis.
Kammeyer, C. E.	Chicago.
Keller, E. E.	Pittsburg.
Kennelly, Dr. A. E.	Philadelphia.
Kerr, H. H.	Chicago.
Korty, L. H.	Omaha.
Lane, H. Vance	Omaha.
Lindsay, W. E.	St. Louis.
Lovett, Israel	Omaha.
McKissick, Mr.	Auburn, Ala.
Morgan, Jacque L.	Kansas City, Mo.
Murphy, Frank	Omaha.
Nash, F. A.	Omaha.
O'Hara, J. B.	Chicago.
Owens, Prof. R. B.	Lincoln, Neb.
Pope, Ralph W.	New York.
Reichmann, F.	Austin, Texas.
Rogers, A. S.	Omaha.
Rosewater, E.	Omaha.
Rosewater, Andrew	Omaha.
Rustin, H.	Omaha.
Scott, C. F.	Pittsburg.
Shaw, H. B.	Columbia, Mo.
Shepardson, George D.	Minneapolis.
Shurig, Edward F.	Omaha.
Steinmetz, Charles P.	Schenectady.
Stieringer, Luther	New York.
Umsted, W. W.	Omaha.
Wattles, G. W.	Omaha.
White, William F.	Omaha.
Woodbridge, J. E.	New York.
Yost, C. E.	Omaha.

The headquarters of the Institute was at The Millard, and the meetings were held in the Bee building.

The opening session, which was largely a preliminary meeting of a social character, was called to order by the president, Dr. A. E. Kennelly, who announced that the mayor of the city had been called out of town and had deputed the president of the City Council, the Hon. W. W. Bingham, to welcome the visitors in his name. Mr. Bingham extended a cordial greeting and presented President Kennelly the keys of the city.

The next speaker was the Hon. G. W. Wattles, president of the exposition, who also welcomed the visitors and expressed the hope that they would find much to interest and entertain them during their meeting. He made a flattering acknowledgment of the work of Luther Stieringer, who had designed the lighting effects, and Henry Rustin, who has charge of the power plant.

Edward Rosewater, an old-time telegrapher, who is also interested in the exposition, related some reminiscences of the early days of the telegraph, which were appreciated. He had an autograph letter from Professor Morse, written 40 years ago, in which he was advised to observe closely the phenomena of electricity as demonstrated on the wires, and thereby perfect himself in the great science, explaining incidentally that there were no books to be had at the time containing information on the subject. This incident was related to impress the importance of the advancement that had been made in the study of electricity as an exact science.

Chairman Dickey of the entertainment committee was called upon to outline the programme that had been prepared, but he refused to divulge the secrets of the Knights of Ak Sar Ben. He announced, however, that by special dispensation the curfew law had been suspended during the sessions of the Institute.

The president announced that several invitations had been received, including one from the Union Pacific Railroad company and another from the Omaha Smelting Works, granting the visitors an opportunity to examine their plants. Both were accepted with thanks. It was also stated that a trip to South Omaha and a trolley party had been arranged, for which the members were indebted to

the local committee. This concluded the opening exercises, and the Institute then proceeded to the regular order of business.

The first feature on the programme was the inaugural address by the president, Dr. A. E. Kennelly of Philadelphia. This was followed by a paper on the "Dielectric Strength of Air," by Charles P. Steinmetz of Schenectady. In the absence of Mr. Howell the secretary read the paper on "Two-wire Distributing Systems and Lamps at 220-240 Volts." The discussion which followed was one of the most interesting features of the meeting. The last paper on the list for Monday was a contribution by Charles F. Burgess of Madison, whose subject was "A Capillary Electrometer for Electrical Measurements." It was received with considerable favor, and although the hour was late, attracted much attention and favorable comment. The meeting then adjourned until 9 a. m. Tuesday morning.

The first order of business on Tuesday morning was the reading of a paper by George A. Damon of Chicago on "A Modern Electric Central Station." Messrs. Steinmetz, Arnold and Humphrey participated in the discussion. The "Preliminary Report of the Committee on Standardization" was presented by Dr. Crocker, the chairman of the committee. This report has been printed by the Institute for the information of members, but not for general distribution, as it has not yet been adopted by the organization and is subject to change. The discussion of this report occupied the remainder of the morning session and proved to be the principal feature of the meeting.

On Wednesday Albert H. Armstrong of Schenectady read his paper on "Some Phases of the Rapid Transit Problem," and Ernst J. Berg, also of Schenectady, followed with a paper on 'Transmission and Distribution of Power for Railway Service." Both papers were discussed. Prof. George D. Shepardson of the University of Minnesota read a paper on the telephonic disturbances in Minneapolis created by railway circuits and the three-phase rotary converters in the hydraulic power plant. A memorial of the late Dr. Emery was reported by a committee and adopted.

Professor Owens was indefatigable in his efforts to provide for the comfort and convenience of the visitors, and he certainly deserves much credit for the success attained. He was commended on all sides for the thoroughness of the arrangements which he made for the meeting.

FEATURES OF INTEREST.

Monday afternoon was devoted to an inspection of the Omaha and Grant Smelting company's plant and the shops of the Union Pacific Railroad company. The visitors, under the direction of the entertainment committee, first visited the smelting works, where they were met by Walter T. Page, the general superintendent, who conducted them through the several departments. Leo Bilodeau explained the general process employed. In the silver and gold department Fred Shaeffer, the superintendent, gave an interesting account of the development of that feature of the industry and showed several samples of the company's product. The visitors then examined the electrolytic features and the assay department, the latter under the guidance of L. J. W. Jones, who very courteously furnished all the information desired. This part of the plant was particularly interesting, as it furnished an opportunity to judge of the progress that had been made. For instance, an idea of the accuracy attained may be gathered from the fact that the scales and balances of the measuring instruments employed are capable of showing the difference in weight of a sheet of paper when perfectly plain and when bearing pencil marks. The capacity of this plant at present is 250 tons of lead daily, 20 tons of metallic copper and 15 tons of sulphate of copper, $20,000 worth of gold and $35,000 worth of silver. It is claimed that this is the largest plant of the kind in the world, yet very few mechanical devices are used, although it did not require an experienced eye to notice many places where labor-saving devices might be introduced advantageously.

When the visitors inspected the Union Pacific railway shops they found an entirely different condition of affairs. In the latter place everything possible was done by mechanical power. For the benefit of the visitors the master mechanic ordered a locomotive engine lifted by compressed air, and in order to demonstrate the safety of the system the supply tubes were suddenly cut away while a gang of men was employed in making repairs. The engine gradually sank back to its normal position. This establishment is one of the largest of the kind in the country, being the principal shops of the Union Pacific company. Everything used in the mechanical equipment of the road is made here, locomotives, cars, trucks and wheels included.

On Monday evening special provision was made for the initiation of the visitors as Knights of Ak Sar Ben. This is a local organization, including the leading business men of the city, the object being to promote interest in local industries, to improve the business of Omaha and attract enterprise and capital to the city. The exercises were unique and greatly amused the visitors. Fully 30 pilgrims approached the ruler of Quivera, and several among them participated in the tournaments. A few prominent engineers distinguished themselves in the games and contests and proved conclusively their worthiness to wear the title Sir Knight. At the conclusion of the exercises luncheon was served in another part of the Coliseum and the visitors left with very kindly feelings toward their entertainers.

Although it was then 10:30 and the exposition grounds were closed at 11 o'clock, it was determined to visit the grand court and view the illumination. The scene presented amply repaid the effort. The spectacle is one that cannot be described, nor can it be effectively reproduced. The harmony that prevails can only be appreciated by those who have witnessed the attempts in the same line that have been made elsewhere. The picture is pleasing to the eye; there is nothing harsh or discordant—in fact so restful and beautiful is the scene presented that one is apt not to fully appreciate the thought and care that must have been expended in the production. The visitors were taken in launches about the lagoons, and were permitted to view the electric fountain Nautilus, after all the lights about it had been extinguished. This was really one of the most impressive scenes presented.

Another feature of the illumination was a sign in incandescent lamps over the band-stand in the Midway—"Welcome A. I. E. E."

Tuesday afternoon and evening were devoted to visits to the exposition. The members were entertained at the German village. J. B. O'H.

Three-phase Transmission for Railway Work in Dublin.

H. F. Parshall, the American engineer, lately described before a London engineering society the Dublin Southern tramways. This installation was remodeled to comply with the regulations of the Board of Trade. The machinery had been ordered and the work proceeded with before Mr. Parshall was retained. The problem became, therefore, to utilize as much of the machinery ordered as possible, and to install such other machinery as would be necessary. The high-tension alternate-current method of transmission was considered most suitable. It was necessary to make use of the sites owned by the Tramway company and to execute the work as cheaply as was consistent with safe operation. The three-phase machines and switchboards were specially designed for the installation, which was the first one of its kind established in the British Isles.

The installation has been in operation for nearly two years and has been found entirely satisfactory. The operation of the sub-stations is so simple that only a boy is employed in each station to run the machinery. Owing to the low frequency the motors are easily synchronized, and even though they are thrown in considerably out of phase they quickly fall into step. Since the opening of the road the load has been greatly increased by a considerable number of additional cars and trailers, yet the machines have given no trouble and the synchronous motors have not fallen out of step even with the most severe loads. The requirements of the Board of Trade have been satisfactorily met, and, owing to the number of points of distribution, it is possible to work some 60 cars on the line instead of 20, as originally designed to comply with the Board of Trade regulations. As originally designed, the fall of potential in the earth return would have been some 18 to 20 volts, whereas in the present installation it is 3½ volts. The efficiency of the machines in the sub-stations is not so high as would be the case with larger machines and large rotary converters.

Girl and Bicycle on a Car Fender.

[From the Buffalo Courier.]

As a Cold Spring trolley car in Main street ran at a high rate of speed down the hill from High street and dashed past North street last night it struck Miss Nellie Cahill, who had attempted to cross the track in front of it on a bicycle. The bicycle ran on the fender and struck the front of the car with terrible force. Miss Cahill fell from her wheel and landed on the fender. Her bicycle was by her side for a distance of 40 or 50 feet, when its rear wheel was caught by some obstruction on the pavement and the wheel was tumbled off and thrown to one side of the car. On account of the speed of the car the motorman was unable to stop it inside of half a block, although he applied the brakes until the wheels slid along the rails and threw off a trailing shower of sparks. In her perilous ride Miss Cahill clutched the iron frame of the fender and bravely kept her position. The skirt of her dress, which fell over the side of the fender, caught on obstructions, and several times, as pieces of the garment were torn away, the strength of the young woman in her efforts to retain her position was tested severely, but she held on. The car, with Miss Cahill on the fender, ran a distance equal to an ordinary half block, when it stopped. Miss Cahill didn't wait to be lifted from her seat. She wasn't hurt, and her bicycle was only slightly damaged.

Death of Alexander Kempt.

Alexander Kempt, formerly one of the prominent electrical men of the West, died at his home in Chicago on Tuesday, June 28th. Mr. Kempt had charge of the Chicago office of the Brush Electric company for several years and took an active part in the affairs of the old Chicago Electric Club. Mr. Kempt was a man of kindly heart and fine ability. The news of his death will bring real regret to many hearts.

Telephone News from the Northwest.

[*Continued from page 5.*]

mile of conduits in the alleys between Nicollet and Hennepin avenues. Materials for the work are arriving steadily.

The Eureka and Mound City Telephone company has been incorporated with $2,000 capital stock to build telephone lines between Eureka, S. D., and Mound City.

The council of New Richmond, Wis., has refused a franchise to the Northwestern Telephone Exchange company.

A local telephone company is being formed at Rhinelander, Wis.

The Mutual Telephone company has extended its wires to Altoona, Ia.

The Northwestern Telephone Exchange company has been considering a line from Litchfield, Minn., to Eden Valley, but not receiving much encouragement, it is probable the line will not be built.

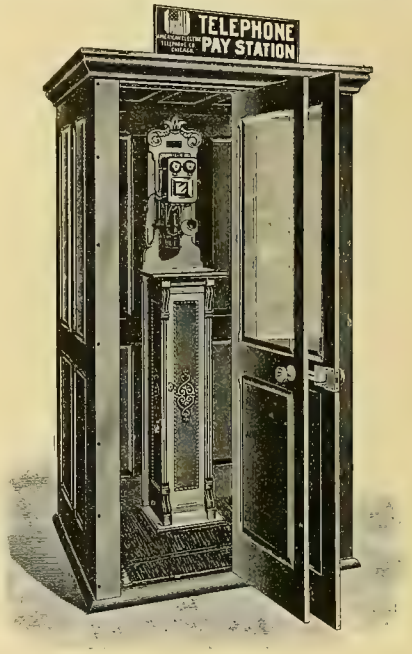
The new telephone line between Aberdeen, S. D., and Eureka, is doing a rushing business so far.

The Crookston Telephone company of Crookston, Minn., has been sold to local parties, and a new set of officers chosen. The line to Fisher, Minn., will be sold to the Northwestern Telephone Exchange company, which will use it as part of the line to Grand Forks, N. D.

P. G. Reynolds, superintendent of construction for the Southwestern Telephone and Telegraph company, covering Arkansas and Texas, has been appointed superintendent of the Northwestern Telephone Exchange company, with headquarters at Minneapolis.

American Sound-proof Booth.

The accompanying cut illustrates one of the many high-class telephone specialties that are now being pushed by the American Electric Telephone company of Chicago. This sound-proof telephone booth is made after the pattern shown in a variety of woods,



AMERICAN SOUND-PROOF BOOTH.

and is elegantly finished, as will be seen from the illustration. It is fitted with double doors and plate-glass windows, and is in every way an ornament.

In addition to this booth, the American Electric Telephone company is now pushing a number of improved telephone slot machines that are worthy of careful investigation, to say nothing of its great variety of new features in telephone apparatus.

Extensions and Improvements.

The increase in the use of telephones in New South Wales during the last two years is phenomenal, and can be traced directly to the fact that the postmaster-general decided to reduce the rates at that time. During last quarter 344 new connections were made. The demand does not seem to be abating. The lately installed Newcastle line is showing good returns; the revenue for March was £46 12s. 6d., or at the rate of about £500, which should pay well.

The actual work of construction of the telephone exchange at Albia, Ia., has been commenced; a map of the route of lines has been submitted to the committee of streets, and I. M. Graff, superintendent of construction, spent two days laying out routes. Material has been ordered and work will be prosecuted with vigor. The exchange will be opened with 75 subscribers, the list including both railroad depots and the leading business houses, besides 25 residences. The apparatus will be furnished by the Northwestern Telephone Manufacturing company of Milwaukee, Wis.

New Management of the Western Telephone Construction Company.

Among the changes that have taken place in the independent telephone field none more radical are to be recorded than that which marked the reorganization of the Western Telephone Construction company of Chicago. At the annual stockholders' meeting in March the controlling interest in the concern changed hands, and the internal dissensions which had marred the company's record during the last year were effectually disposed of. The entire control of the property was placed in charge of President Keelyn, who was re-elected for the fifth time. Since that time the company has made great advancement, its facilities for manufacturing have been improved, its factory enlarged and several important and valuable devices added to its list of specialties. The company has also been fortunate in securing the co-operation of several influential telephone men whose alliance cannot fail to strengthen it.

James E. Keelyn, who continues to be the controlling spirit in the company, is a native of Albany, N. Y., but for 30 years he has lived in the West, and much of that time in Chicago. Mr. Keelyn entered the Wisconsin Telephone company's service when it was formed, and was manager of the Racine exchange from 1880 to 1885. Anticipating the expiration of valuable patents held by the Bell people, he began preparations to re-enter the telephone business in 1890, and he formed the Western Telephone Construction company of Chicago, as noted elsewhere in this issue. He has since been closely identified with the independent telephone business and is an aggressive factor in the movement.

The Hon. D. A. Holmes, who was elected vice-president, is a new comer in the independent telephone field. Judge Holmes is one of the most prominent lawyers in the West. He is a law partner of United States Senator Mason, the firm being Mason, Holmes & Mason, which will hereafter be the general counsel of the company.

Harry C. Dodge, the general superintendent under the reorganization plan, was associated with Mr. Keelyn in the formation of the Western Telephone Construction company, but he has not been identified with it since its early days. He has been identified with the development of telephone and electric-lighting enterprises, power transmission and general electrical construction work during the last 15 years. A considerable portion of that period was spent in the telephone field, especially in the management of exchanges and toll-line systems controlled by the Wisconsin and Central Union Telephone companies. Mr. Dodge's early experience in the independent movement was acquired as promoter and organizer of sub-companies for the Western Telephone Construction company. He was one of the organizers and incorporators and the general manager of the Northwestern Telephone and Electric company, and he was the original promoter and one of the incorporators of the Standard Telephone and Electric company of Madison, acting as chief electrician and general superintendent of the latter company from the date of its incorporation until he resigned to become associated with P. C. Burns of the American Electric Telephone company as general manager. Mr. Dodge withdrew from the American company to accept his present position upon the reorganization of the Western Telephone Construction company.

B. F. Stewart, who was made secretary, is one of the oldest and best-known men in the electrical business, although still in the prime of life. He occupied an official position for four years with the Western Electric company, and for seven years had charge of the Westinghouse Electric and Manufacturing company's railway business. He has been engaged in the electrical business for 20 years, and his general knowledge of the trade and wide acquaintance in every department of electrical work will prove valuable to the company.

The Postal Telegraph company has opened an office in Ishpeming, Mich.

THE TELEPHONE TRADE.

The Eastern Illinois Telephone company has just completed the installation of the new Sterling Electric company's standard switchboard at its exchanges in Gilman and Sheldon, Ill.

Secretary Kimmel of the Southern Illinois Telephone company of Mount Vernon now occupies an easy chair in the rear of the room and enjoys life, having just installed the complete apparatus of the Sterling Electric company of Chicago.

The Livingstone County Telephone company of Pontiac, Ill., has completed its new exchange building. The poles are erected and the wiring is now being put up for the removal of the central office. This new office will be equipped throughout with the standard apparatus of the Sterling Electric company of Chicago.

Dr. F. A. Winne of Brockport, N. Y., has one of the most successful and best equipped telephone exchanges in the independent field of Western New York. The outside construction is fine and the central-office equipment is the standard apparatus of the Sterling Electric company of Chicago. The exchange opened June 5th under the most favorable auspices.

The Sterling Electric company of Chicago, on account of the rapid increase in business, finds it necessary to open a southwestern office in St. Louis. H. A. Coit, formerly manager of the Missouri Telephone company, and one of the best known men in the independent telephone field, will have charge of the company's business in that territory, carrying a full line of the Sterling samples and taking charge of the southwestern business from his office in the Laclede building, St. Louis.

The Moravia (Iowa) Tribune states that Charles McFatridge has staked off the new extension of the Moravia telephone line from Iconium to Milledgeville, where he will connect with the Iowa and Missouri Telephone company, which reaches nearly all the towns in Southern Iowa and Northern Missouri. Thomas Brandon, Dr. Riodan and other citizens of Melrose are also making preparations to erect a line to Iconium and join the Mutuals. The Mutuals at Ottumwa will connect with the Moravia line at Blakesburg.

The Western Telephone Construction company has good reason to be proud of two recent orders. One is for a 2,000-wire multiple switchboard for the main exchange of the Newark (N. J.) Telephone company, which is said to operate the largest independent telephone exchange in the world. The other is from the Southern Illinois Independent Telephone association, which has decided to use the Western Telephone Construction company's toll-line instruments and toll-line switchboards in order to have uniform apparatus for toll service.

Following is a copy of a letter from M. J. Dillman, vice-president and general manager of the Capital Telephone and Telegraph company of Sacramento, Cal., to the American Electric Telephone company of Chicago:

I notice in the April number of a monthly periodical called The Telephone, and published in Chicago, an article referring to the suit recently decided in part against our company and in favor of the Western Electric company of Chicago, in which they make a statement with the evident purpose of conveying the impression that the apparatus in question was purchased from the American Electric Telephone company. That you may be placed in the proper light before the independent telephone companies of the United States, I will say that the suit in question was upon the alleged use, by us, of a multiple switchboard, and was instituted on the 16th day of October, 1895. The very first purchase made by us of your company was on or about the 15th of February, 1897. We then entered upon the work of making a thorough test of half a dozen or more transmitters manufactured by what appeared to us to be the leading telephone manufacturers of the United States. After fully satisfying ourselves as to the merits of each instrument we adopted your telephones, and up to the present time we have failed to find anything in the market comparing with your new solid-back amplifying transmitter for either long or short-distance work, and where the conditions are very severe, owing to the large number of electric-light wires in use. Our territorial wires run for 22 miles upon the poles of the Sacramento Electric, Gas and Railway company, over which is carried 10,000 volts. As to the suit decided against us, I will state that it was an "empty victory," so far as we are concerned, for we have never used the boards in multiple and have no desire to do so. The Western Electric company got no damages, paid their own costs, and were simply granted an injunction restraining [illegible] using the boards in multiple. As to the defense of the [illegible] I will [illegible] that with such attorneys prosecuting [illegible] Barton of Chicago and Roberts of Boston [illegible] patent expert, [illegible] of Chicago, the [illegible] attorneys, Messrs. J. H. Miller of San Fran[illegible] of Chicago, the latter having been [illegible] company, entirely unaided on our part, [illegible] the least by comparison. I trust that the [illegible] prove an eye-opener to all persons who may have [illegible] at the conclusion that the American Electric Telephone company's apparatus was dangerous to use.

In the important matter of cord for switchboard connections and other purposes, C. H. McEvoy of Lowell, Mass., calls the attention of telephone manufacturers and exchange companies to his "Dura" telephone cord with its patent hook tip. The demand for this telephone cord shows its excellence. The business is steadily increasing, necessitating a constant expansion in facilities for manufacture. Mr. McEvoy's connection with the manufacture of telephone cords dates back to the year 1879, when he entered the employment of the Lowell District Telephone company of Lowell, Mass. He found that one of the greatest troubles the company had was due to defective cords, and from his experience in repairing broken cords he invented new methods, with sufficient success to make all the cords used by the various companies under the management of the Lowell Telephone syndicate, as well as to extend the business to other Bell companies and in later years to the independent telephone companies and manufacturers. The leading feature of his cords is the patent hook tip. This is entirely different from any other method, and is confidently claimed to be superior, as it combines the strength of the conductor and the covering, using the full strength of the latter.

Boardman & Tucker is the title of a firm that has just established itself at 97 Oliver street, Boston, where it will manufacture on an extensive scale a new line of telephones which possess many points of excellence and efficiency. The members of this firm are Mr. Arthur F. Boardman and Mr. F. S. Tucker, both of whom have been in the telephone field for many years, with wide and varied experience. Mr. Boardman is an electrical expert, formerly and for some years connected with the American Bell Telephone company, for which he made some valuable improvements. Many prominent and successful workers in the telephone business were from time to time associated with him in the Bell company's laboratory and owe much of their subsequent success to the valuable assistance they received from Mr. Boardman. Subsequently he allied himself with the National Telephone Manufacturing company, Boston, one of the first independent telephone companies in the country. At that time the National company was manufacturing a mechanical telephone, but, availing itself of Mr. Boardman's skill and experience, an electrical telephone was put on the market and has come into general use. Believing there was a good opening for the introduction of further improvements, Mr. Boardman established the present business, associating with him Mr. Tucker, one of the leading mechanicians in the country, with many years' experience in the manufacture of telephone instruments. Though established but a short time, this combination has already achieved signal success, and the outlook for the future is more than promising. Nor is this to be wondered at, seeing the record each member of the firm has made in the past. Mr. Boardman was the first one to build and install a large common-battery telephone exchange, which was done for the Home Telephone company at Mobile, Ala., having no less than 500 subscribers. A second large exchange on the same principle was also erected at Stoughton, Mass. Both of these exchanges were successful, as were others. Since the new firm started it has been kept quite busy on government contracts for portable telephone sets, to be used by submarine divers. These are of a special type, both receiver and transmitter at one end of the line being attached inside the diver's helmet, while the battery is fixed in a leather pouch carried by the diver's attendant in the boat or on shore. This apparatus is proving a great success, and was selected by the Navy Department of the government because of the fact that

J. E. Keelyn.

Hon. D. A. Holmes.

H. C. Dodge.

B. F. Stewart.

NEW MANAGEMENT OF THE WESTERN TELEPHONE CONSTRUCTION COMPANY.

there is no danger of "packing" in the transmitter. The new firm's double-pole receiver is another specialty possessing many points of excellence, and is coming so rapidly into demand that already Boardman & Tucker are planning to increase their manufacturing facilities to supply the demand. The firm's improved desk set is also attracting a large share of attention, and many good orders are being received for it. With its increased facilities this enterprising firm hopes in a few weeks to be able to take care of the large business that is rapidly coming its way.

Electric Shop-yard Haulage.

A striking instance of economy in actual money and elimination of trouble and delay induced by supplanting a steam-haulage service with electric traction is afforded by the installation recently made for the Arlington Mills, Lawrence, Mass. These mills have about two miles of track running from

FIG. 1. ELECTRIC SHOP-YARD HAULAGE.

the main line of the Boston and Maine railroad into the yards and throwing off spurs into the alleys between the different buildings. Previous to the change to electric service, the haulage of the entire output of the mills to the main line, the haulage of the material from building to building, as well as the necessary switching about the yards, was done by a steam locomotive rented from the railroad. For this service the Arlington Mills paid an annual rental of several thousand dollars, and were, moreover, frequently put to great inconvenience and delay on account of the unavailability at times of any locomotive.

The successful results obtained with electric factory locomotives by other mills in New England, notably at Whitinsville, Mass., and Taftville, Conn., attracted the attention of the managers of the Arlington Mills to the question of electric haulage, which they took into serious consideration. As every case in which electric traction has been adopted in factories showed an improved service, as well as an actual money economy, electricity as a motive power was decided upon.

The electrical installation supplied by the General Electric company consists of a small generating

FIG. 2. ELECTRIC SHOP-YARD HAULAGE.

plant and two electric locomotives, one of the box type and the other a platform car. The generating plant consists of a standard 75-kilowatt, 500-volt railway generator, driven by a belt from an Armington & Sims high-speed engine. The generator readily answers all calls upon it, with no heating or sparking, although it is occasionally subjected to very heavy overloads when both cars are handling a train of more than the usual number of loaded cars.

The box-car locomotive used for hauling material about the yards is shown in Fig. 1, and is equipped with two 27 horse power motors and series parallel controllers. The platform locomotive is used to haul trains of loaded cars from the yards to the main line and empty cars from the line to the mill tracks, and to do all the drilling in the yards. The equipment of this locomotive consists of two 50 horse power motors, with the necessary series parallel controllers. In hauling heavy trains it is assisted by the box-car locomotive. Together they are able to handle trains of 30 to 40 empties, or 12 to 14 loaded cars, with comparative ease and celerity. To give the necessary adhesion to the more powerful locomotive to enable it to handle heavy loads, about six tons extra is placed on the platform.

Perhaps the most interesting feature is the comparison between the cost of the electric plant and the expense formerly entailed by the use of the superseded steam locomotive. The cost of the entire electric plant was very little in excess of one year's rental of the steam locomotive. No more men are employed about the electric locomotive; the labor cost has not risen, and the consumption of coal is scarcely felt on the main plant. Furthermore, the plant, being always ready, cars may be shifted at any time during the day or night.

The new system is thus both economical and advantageous, and the appreciation of the Arlington Mills is, perhaps, best shown by the fact that a second platform locomotive is shortly to be added to this haulage plant. Fig. 2 shows the platform locomotive now in use and a train of cars attached to it.

The Italian Market as an Outlet for Electrical Machinery.

In 1899 the centenary of Volta's discovery of the electric pile is to be celebrated in Como, his native town, by an international exhibition of electrical appliances, which will no doubt be most important and interesting.

The use of electricity, both for lighting purposes and as a motive power, is constantly extending throughout the whole of Italy, and there is consequently an ever-increasing demand for all kinds of electrical appliances connected with this development. Some of these are now made in Italy, but by far the greater part is imported from Switzerland and Germany, two countries which appear to have made this industry, which has undoubtedly a splendid future before it, quite a specialty of their own, and they must find it a very profitable one. American engineering firms do not seem to be making any effort to secure a share of this business in Italy.

It seems that our manufacturers have overlooked Italy as a market. A country with 32,000,000 inhabitants, poor in raw materials, is naturally obliged to import. In 1896 Italy imported machinery to the value of 28,187,824 lire, or about $5,637,560, to which the United States contributed the unimportant item of $55,413.

The following tables show the imports of electrical machinery, etc., for the year 1895:

ELECTRICAL MACHINERY WEIGHING MORE THAN 1,000 KILOGRAMS (2,240 POUNDS).

From Austria	131,320 francs
Belgium	19,110
France	14,455
Germany	206,290
England	69,090
Switzerland	668,605
United States	66,885
Total	1,775,755 francs

ELECTRICAL MACHINERY WEIGHING LESS THAN 1,000 KILOGRAMS.

From Austria	84,010 francs
France	9,920
Germany	236,840
England	75,950
Holland	4,030
Switzerland	88,040
United States	119,660
Total	618,450 francs

This makes a total of 1,794,205 francs for the imports of electrical machinery, to which was contributed by the United States 186,545 francs, or about 11 per cent.

In 1896 the imports of electrical machinery into Italy rose to the value of 2,782,110 francs, while in 1897 they reached the amount of 3,116,210 francs.

The imports of "electrical appliances" in 1897 were as follows:

From Austria	153,300 francs
Germany	158,350
England	224,700
Switzerland	15,750
United States	8,050
Total	560,350 francs

In the course of the next few months the Edison company, which works the electric railways of Milan for the municipality, will bring into Milan a force of nearly 10,000 horse power, obtained from the River Adda at Paderno. Six turbines, each of 2,160 horse power, with a seventh as a reserve in case of accidents, will be employed for developing the water power and conveying it to the dynamos, which will be seven in number, and the electric current will be carried from Paderno to Milan, a distance of 20 miles across country, by means of overhead wires. These turbines are said to be the most powerful in Europe, and are being constructed by the firm of Riva, Monneret & Co. of Milan. It is estimated that the loss of power in transit will not exceed nine per cent.

Of the nearly 13,000 horse power to be thus developed, 2,000 is already disposed of in the town of Monza. The remainder will be brought to the city of Milan, and any surplus that may remain after providing for the public and private lighting of the city and the working of the tramways will be let for industrial purposes.

Many other electric plants are under contemplation in Italy. Among the most important is the construction of an extensive electric street-railway line in Catania, a city of nearly 125,000 inhabitants, situated along the sea coast, at the foot of Mount Etna, on the island of Sicily.

An American electric street railway in Catania would be a great standing advertisement for American industry and an entering wedge for our commerce into Sicily, especially in machinery, tools, etc.

Foreigners have the same privileges in Italy to do business as Italian citizens, and there is no reason whatever why we should not claim a fair share of the Italian trade.

A good opportunity for American manufacturers to view the class of goods imported into Italy is offered by the present exhibition of Turin, which will be closed in October. Further particulars may be obtained from the General Exhibition Committee at Turin (Comitato della Esposizione Generale di Torino, Torino, Italy).

BOOK NOTES.

"The Cost of Generation and Distribution of Electrical Energy" is the title of a paper read by Robert Hammond before the Institution of Electrical Engineers at London on March 24th, and subsequently printed in pamphlet form. The document makes a good-sized pamphlet and conveys a comprehensive view of English practice. There are many valuable tables and diagrams and the statistical information contained between the covers should insure a place for the work in American as well as English libraries.

Poole Bros.' Mining Directory and Reference Book of the United States, Canada and Mexico for 1898 is an imposing volume of 926 pages. It contains lists of mining and quarrying companies and operators and of those engaged in the closely allied industries. There is much other information for mining men, including digests of the mining laws and a map of the Klondike gold fields. One feature is a list of mining, mechanical and electrical engineers in the different states, but, judging by the Chicago names given, the list is far from complete. The price of the book is $6, and it is published by Poole Bros. of Chicago.

Although somewhat belated, this year's "Electrical Trades' Directory," issued by the London Electrician, is none the less appreciated. The present volume, which is the sixteenth year's issue, continues to bear substantial evidence of the popularity of the work. Among the new features may be mentioned the "Electric Tramway Order" in its latest form, the "Board of Trade Standardizing and Testing Regulations," the new fire-risk rules adopted in the United States and the lists of government telegraphic and electrical departments. The statistical and other valuable information published has been carefully revised, amplified and brought up to date, and the publishers say may, consequently, be relied upon as being complete and correct, including the revision of Mr. H. G. Cheesman's wire-gauge table, the sheet table of supply stations, and the sheet table of electric railways and tramways. Particulars have been added relating to the fire-risk rules of the leading offices (including the copyright rules of the Liverpool and London and Globe offices), systems of charging for electric current and important details regarding the Cadmium cell. The publishers wish to draw attention to the biographical section with more than usual satisfaction. Not only have the notices increased in number, but the portraits have been vastly improved by means of half-tone reproduction, closely approximating to the photograph itself. In every way the work is highly creditable and thoroughly satisfactory.

Construction of Statute Requiring Painting of Poles.

Provision is made in the Vermont statutes (Section 4229) that a person or corporation owning or operating a line of wires in a city or village shall cause the poles upon which the wires are strung to be kept suitably painted, to the satisfaction of the aldermen of the city or the trustees of the village, and substitute straight poles for crooked ones. The next section provides that a person or corporation neglecting or refusing to paint such poles or make such substitution, after a prescribed notice has been given, shall forfeit $100 to the city or village, to be recoverable in an action upon the statute.

This being a penal statute, the Supreme Court of Vermont holds, in the case of the village of Hardwick against the Vermont Telephone and Telegraph company (40 Atlantic Reporter, 169), that it must be construed according to the intention of the Legislature, as discovered by the import of the words used. It is not sufficient, in an action brought to recover the penalty, that the precise terms of the statute be followed in stating the cause of action. The latter must be set forth according to the legal meaning of the statute.

The provisions of the sections mentioned apply to all cities and villages where telephone and telegraph wires are maintained, and the court holds it is to be presumed that the Legislature intended that a notice from the aldermen or trustees should indicate, by streets or other localities, where a substitution of poles should be made, and also direct what color they should be painted, inasmuch as the statute requires that they shall be painted to the satisfaction of such aldermen or trustees.

An offense under the statute was not committed, the court continues, by the company maintaining unpainted and crooked poles, but by neglecting to do certain things within 20 days after notice to do them; wherefore, the notice should state specifically what was required.

The averment that the company had not, and did not, "substitute straight poles for crooked ones then or thereafter erected, but, on the contrary, maintained crooked and unsatisfactory poles," the court, last of all, expressly holds, is not a sufficient averment that crooked poles were poles upon which wires were strung in the village that was suing the company.

Curious Situation in Pasadena.

[From the Pasadena (Cal.) Star.]

For a year past the city of Pasadena has enjoyed the privilege of having the local electric railway pay the bill for lighting the city's streets and public buildings. The amount paid each month has averaged over $1,000, and now approximates $1,100. The saving is a considerable one, and is dependent, as everyone knows, upon an understanding (not an agreement) to the effect that so long as no other street-railroad franchise is granted over Pasadena's streets, the railroad corporation will continue to pay the lighting bills. The minute that another franchise is granted the city again begins to pay for its own lighting.

There are now two companies asking for franchises over Pasadena's streets. It is the opinion of nine-tenths of the taxpayers of the city that it will be to the best interests of Pasadena to grant the applications. The platforms of both political parties at the last municipal election contained planks favorable to such action, and the report of the committee on ordinance and judiciary of the council, to which was referred the applications, reported in favor of granting the franchises, Trustee Reynolds not signing the report.

It the franchises are to be sold they should, however, contain provision that will result in the city receiving compensation in some shape that will at least equal the amount which it will lose by letting them come in by reason of being compelled to pay the lighting bills. It could hardly be called unreasonable if the council should insist upon each applicant paying approximately that sum or giving privileges that would equal the cash outlay.

One member of the board of trustees recently made the remark that he believed that the time had passed when Pasadena would be compelled to pay for her own street lighting.

COMMUNICATION.

Acetylene Gas Explosion.

To the Editor of the Western Electrician:

Your accout of the acetylene-gas explosion in my residence was received a few days ago. Your reporter is "way off" in his account of the explosion. I will explain to you how it happened. In changing buckets, I noticed some pieces of carbide that I thought could be used again, so I set the bucket in my woodshed, and covered it over with a heavy cloth. This was about 7 p. m.; at 11 p. m. I went out to see if the carbide had got cool enough for me to handle. Very foolishly I lit a match and removed the cloth from the bucket, and then it was all over in a second. It singed me properly and knocked me about five feet against the wall. The explosion was 50 feet away from the machine, and was not caused when I was cleaning the generator, as your reporter stated. DR. CHAS. BEAVER.

Mancelona, Mich., June 20, 1898.

Copper in Alaska.

[From the San Francisco Chronicle.]

A great body of almost pure copper ore has been discovered in Alaska. The matter is of considerable moment, for the reason that the mineral is in much and increasing demand, principally by reason of the large amounts now used in electrical work. Already Dalton, the famous Klondike explorer, has staked out a large space in the mines and put men to work, and Henry Bratnober, the well-known mining engineer, who is now in the North, is, according to the last reports received here, about to follow his predecessor's example.

The copper is located between the White and Copper rivers. A few months ago an old prospector went to Robert Duncan, Jr., the superintendent of the Treadwell mines at Juneau, and showed him a piece of ore of wonderful richness. It was sent to this city, and, on being assayed, was found to contain 94 per cent. of copper, $30 in gold to the ton, and a small amount of silver. The man stated to Duncan that the ore had been taken from outcroppings of a vein near the White River, having an outlet to the Alsek River, which flows into the Pacific Ocean at Lituya Bay. Bratnober and Dalton decided to make investigations at once, and, if the report was correct, to take up claims without loss of time. A letter has just been received in this city by Captain Thomas Mein from Duncan, in which he says:

"Bratnober left for the inside some days ago, and must be in now about Dalton's Post somewhere. Onderdonk went along with him to stake a claim off on Shorty Creek, on the Dalton trail, about 200 miles in. Dalton has just returned from there, and claims there is a big excitement in there about it. There are about 35 men at work on the creek now and getting big returns. Bratnober will go there also, I believe, to take up a few claims before he goes in to the Copper. Dalton was in at the Copper. He left his men in there, and claims it is there in heaps."

This corroborates the statement of the old prospector who brought in the sample of copper when he said there was enough of it lying around on the surface of the ground to load a ship. The sample of ore in this city is so pure that if the remainder is anything like it there will be no need to smelt it in the North. It can be shipped at once to San Francisco and treated here at a great profit. This discovery is among the most important that has been made in Alaska in a long time. There is yet some question whether the copper deposit is in American or in British territory.

Another War-time Sensation.

[Curtis' Washington Letter in Chicago Record.]

I am compelled to report a violation of the law of the land by such men as the president of the United States, the secretary of war, the secretary of the navy, and the commissioner of public buildings and grounds of the District of Columbia. A statute passed by Congress forbids any telegraph, telephone or electric-light company erecting any more poles or stringing any more wires in the air within the limits of the city of Washington. All wires in the future have to be underground, and subways are being built for them. Nevertheless and notwithstanding, a wire has been stretched in a most conspicuous part of the city between the Navy Department and the White House, in order that the president of the United States may receive and send direct dispatches from and to General Shafter, Admiral Sampson and others with whom he desires to communicate by means of an electric current. When this matter was called to the attention of the district commissioners to-day they admitted that it was a violation of law, and when they were asked why the president of the United States, the secretary of war and other culprits had not been arrested, they replied that no complaint had ever been filed at police headquarters and that the offense was officially unknown to them. They said that when they were notified that this wire was to be erected the police were called off or were instructed to turn their backs, or wear dark-green glasses so that they should not be able to witness the sinful proceedings.

CORRESPONDENCE.

New York Notes.

New York, June 27.—The Kings County Elevated Railroad company of Brooklyn has ordered 41 passenger cars, to be built by the Wason Manufacturing company, Springfield, Mass., and 20 of these cars are to be equipped with electric motors, four motors on each car, by the Westinghouse Electric and Manufacturing company. The trucks will be made by the Baldwin Locomotive Works. This electrical equipment is put on to prepare the cars for running over the bridge to New York.

George J. Gould, president of the Manhattan Railway company, has sent a letter to Alexander E. Orr, president of the Rapid Transit Commission, replying to the latest propositions regarding the proposed West street franchise. Mr. Gould declines to accept a franchise based on the payment to the city of five per cent. of the gross passenger receipts. On this point he says: "This company will not pay a rental of five per cent. of gross passenger receipts of the West street line, whether this franchise be considered in connection with the Bowery and Third and Ninth avenue tracks,' or as 'an isolated grant.'" Under the head of "Interference with Other Rapid Transit," Mr. Gould announces that his company cannot accept a franchise which will limit the policy of the company in the future in the manner proposed by the board. A conference is suggested, but the ideas of the Manhattan directors and the Rapid Transit commissioners are so widely at variance that it is difficult to see how an agreement can be reached.

It is given out that the cable car will soon disappear from Broadway, from Columbus avenue and from Lexington avenue, to give way to the underground electrical system, while the Metropolitan Street Railway company is about to experiment with compressed-air motors on some of the cross-town lines. President H. H. Vreeland of the Metropolitan company says: "We shall use compressed-air motors to propel the cars on Twenty-third street. Work on our compressed-air station on Twenty-third street has been delayed, but we shall be ready to try the new power by the first of the year. The present cable lines on Broadway, Columbus and Lexington avenues will be operated by underground trolley. These routes, with those on Fourth and Second avenues and Fifty-ninth street, will constitute the electrical service for the present. The remaining parts of Eighth and Sixth avenues, for which we have permission to use electricity, will be pushed to completion, but they will not be available until our new power house at Ninety-sixth street and East River is completed." M. S.

Northwestern Notations.

Minneapolis, June 27.—The Montana Power company of Butte, Mont., is in financial straits, and liens have been filed against it aggregating $54,955.21. The company has acquired a lot of land on the Big Hole River, and for a year has been building a power plant there. Some of the stockholders recently refused to put up any more money.

The Fox River Valley Electric Railway company has put the interurban line between Appleton, Wis., and Neenah in operation at last.

The Butte General Electric company bid $12 per month per arc lamp for street lighting in Butte, Mont. The figure is quite satisfactory, as it is considerable of a reduction from former figures. It is based on the cheaper power which will soon be available from the new power dam in the Big Hole River.

In the case of the Edison Electric Light company against the Minneapolis General Electric company and the Thomson-Houston Electric company, in the United States District Court, at Minneapolis, Judge Lochren held that the defendants were in no way connected with the E. G. Barnard company, which was enjoined from manufacturing a dynamo infringing on the complainant's patent. The Minneapolis company is still free to use the dynamo in question until suit is brought directly against it.

The Oshkosh-Omro-Berlin Electric Railway Construction company has been incorporated to build an electric line from Oshkosh to Berlin, Wis.

The electric-light plant of Ortonville, Minn., has been completed and put in operation.

Walkerville, Mont., a suburb of Butte, protests on the rates the Butte General Electric company charges it for light. While Butte escapes with $14 per month for arc-light service, Walkerville has been paying $18.

The Twin City Rapid Transit company is pushing work as fast as possible changing the cable in St. Paul to electric power. The paving alone which the company will have to do will cost $20,000, and the work at the Selby avenue hill will cost about $30,000.

Business firms of Chippewa Falls, Wis., have protested against the street-railway company occupying Spring street with a car line.

The Commercial Light and Power company of Duluth, Minn., has submitted four different propositions for lighting the streets under contract.

The suggestion is made by a daily paper in Rochester, Minn., that an electric line to the summer resort of Oronoco would be a paying investment.

The contracts have been awarded at Algona, Ia., for machinery for the electric-light plant. Westinghouse apparatus will be used.

The Citizens' Traction company of Oshkosh, Wis., has completed its new line to its summer park and put it in operation.

The Kaukauna Electric Light company has sued the city of Kaukauna, Wis., to recover bills for light service for April and May, which the council disallowed. The council had declared the contract with the company void, and for that reason refused to pay the bills.

W. I. Gray & Co. of Minneapolis were the successful bidders for furnishing and installing an electric-light plant for Madison, Minn.

Negotiations have been pending for the past six months for the consolidation under one management of the street-railway lines of Seattle, Wash. It is believed that the deal will be closed at any time now.

The Electric-light Board of Marquette, Mich., has decided to retail electric power. It has 300 horse power available now for consumers and will have more soon.

The officials of the Chippewa Valley Electric Railway company have returned to Chippewa Falls, Wis., from the East and let contracts for the materials

for the road in that city. It is now expected that the work will be pushed through to conclusion as fast as possible.

The electric-light dynamo of Lake City, Ia., was damaged slightly in being shipped, but the contractor thought it would not interfere with its operation and proceeded to set it up. When the plant was started the dynamo wrecked the engine, so that it was necessary to have a number of parts replaced from the factory. The plant was delayed in starting until the parts could be replaced.

E. Cole and Alexander Stern of Fargo, N. D., are understood to propose a small electric-light plant to furnish light for the stores situated in their immediate neighborhood. Messrs. Von Neida and Lockhart of Fargo, and Wagner and Clendenning of Moorhead, are applicants for a franchise for an electric-car line, and General Alex. Hughes and E. A. Hughes of Bismarck for an electric-light plant at Fargo. Between them all Fargo ought to be furnished with electricity soon.

It is understood the electric-light company of Anaconda, Mont., will add a new steam-power plant to its system, with a capacity of 3,000 horse power. With the rapid increase of smelters the output of the present plant has been entirely consumed, particularly in the winter.

The Greenman Electric company of Des Moines, Ia., has filed articles of incorporation, with $10,000 capital stock.

W. B. Baker has let the contract for the construction of the electric line from Waupaca, Wis., to the Chain o' Lakes, to the Electrical Installation company of Chicago, to be completed by July 15th.

The remainder of the stock for the electric line in Escanaba, Mich., has been taken by local capitalists, and the line will be put into operation at once. It will be extended about four miles, to connect with the Soo railroad.

The village of St. James, Minn., will purchase a dynamo of 2,000 incandescent-light capacity.

The Western Electric company of Chicago was the successful bidder for furnishing Rochester, Minn., with wire for the enlargement of the power house, at $1,121.

The District Court at Des Moines, Ia., has overruled a motion on the part of the city to set aside the injunction restraining the city from contracting for an electric-light plant. The council awarded a contract, but it was enjoined on a technicality which the Legislature remedied. But the Supreme Court will have to settle it.

L. T. Treleven and others of Fond du Lac, Wis., have applied for a franchise for an electric street-car line, which they propose to have in operation in less than a year. An extension has been granted on the franchise granted to Rollin F. Allen in 1897.

The council of Iowa City, Ia., will investigate the matter of the purchase of the Iowa City Electric Light company's plant.

The village of Gaylord, Minn., voted to establish an electric-light plant. A recent canvass was made, and over 300 lights were guaranteed. A system to cost about $8,000 will be put in.

The Gas, Electric Light and Street Railway company of Marshalltown, Ia., has mortgaged its plant for $150,000, to make a number of improvements and enlargements.

A. Munch of Pine City, Minn., will construct a dam across the Snake River, and there is talk of forming an electric company to utilize the power and furnish electric light and power to Pine City and other towns in the vicinity.

The old scheme of an electric railway between La Crosse and Neillsville, Wis., has been revived, and it seems as though it might be carried out. New capital has been enlisted, and it is thought work will soon be begun.

The village of Springfield, Minn., has contracted with the Fort Wayne Electric corporation for additional lighting facilities, to cost about $2,000.

The Supreme Court has enjoined the city of Grand Forks, N. D., from paying for the electric-light plant ordered by the council, on the ground that the city has no right to levy so large a tax without an ordinance or a vote of the people. The lower court refused the injunction, and the contractors proceeded to install the plant. It was nearly completed when the Supreme Court decision came.

The Bi-metallic Granite company of Phillipsburg, Mont., is considering establishing an electric power and light plant at Flint Creek Falls, about five miles above Phillipsburg. There is ample power for a very extensive plant, and it is believed the company will complete the plans which were started six years ago, when a dam was constructed.

The electric-light plant at Sioux Rapids, Ia., has been burned out.

The Missouri Valley (Ia.) Electric Light company has changed its charter and become the Missouri Valley Electric Light, Heating and Power company.

An understanding has been arrived at between the Electric Light and Power company and the city of Superior, Wis., by which the lighting company reduces its rates from $33,000 to $11,400 per annum. The city will drop the proposed municipal light plant.

It is reported that the electric-car line between St. Paul and Wildwood, in Washington county, Minn., has been sold to Thomas Lowry.

The directors of the Electric Light and Power company of Chatfield, Minn., voted to reduce rates for lighting 25 per cent. as soon as 1,000 lamps are subscribed for.

The St. Cloud City Street Car company's property in St. Cloud, Minn., has passed into the hands of the Benton Power and Traction company. This company proposes to build two dams across the Mississippi River, one at Sauk Rapids and one above that village.

J. C. Hubinger of Keokuk, Ia., has been granted a franchise for a street-railway system in Quincy, Ill.

The council of Waupaca, Wis., has granted a franchise to Mr. Baker and others for an electric-railway line.

The Murray Iron Works of Burlington, Ia., will furnish the engine for the Sac City Electric company's light plant at Sac City, Ia.

The Supreme Court has decided against S. G. Peterson of New Ulm, Minn., in his suit for libel against the Western Union Telegraph company in transmitting an anonymous message reading "Slippery Sam, your name is pants." The case has been up to the Supreme Court several times, and has been remanded for a new trial every time until now.

The council of St. Cloud, Minn., has voted to pay the Water and Light company $80 per light per annum for arc street lights.

The council of Two Harbors, Minn., proposes to borrow $4,000 from the Minnesota Iron company, if possible, for an electric-light plant. If this cannot be done, a bond issue for the same amount will be submitted to popular vote. C.

Canadian Intelligence.

Ottawa, June 27.—It is said that the Grand Trunk Railway authorities have not yet come to any definite conclusion regarding the adoption of electricity for hauling trains through the Sarnia tunnel.

The amalgamation of the Quebec and Montmorency railway and the Quebec District railway is said to have been effected. The motive power of the former road will likely be converted to electricity.

The adjourned annual meeting of the shareholders of the Hamilton, Chedoke and Ancaster Electric Railway company was held at Hamilton, Ont., recently. The reports as to the disposition of the stock showed that the company's prospects are brightening up considerably, and that the railway may yet be built sooner than is at present anticipated. About $30,000 of stock has been placed, and the company wants to dispose of $10,000 more before beginning active operations.

The Hull Electric Railway company of the city of Hull, Que., has adopted a new style of ticket for use on its road. The ticket is a metal one, composed of aluminum, with the letter "H" in copper in the center. It is about the size of a 10-cent piece, but instead of being round has six sides to it. The Hull company is the only one in Canada using this kind of tickets.

The report of Mr. James Milne, the electrical expert employed by the city of Toronto to make a report on the cost of an electric power supply for street lighting and commercial purposes for Toronto, is against the city erecting a commercial plant. The expert reports that the data received from users of both electric and steam power are not to be absolutely relied on for the purposes of careful calculations, owing to the different bases upon which the various returns have been prepared. The summary of steam users shows a consumption of 16,802 horse power, from which may be deducted 10,000 horse power for the Toronto Electric Railway company, electric-light and incandescent-light companies' plants, leaving 6,802 horse power for commercial purposes. Of this amount, he says, nearly 1,000 horse power could be supplied by electric power or gas as cheaply as at present, but for the remaining 5,800 horse power it is useless trying to persuade the manufactures to change from their present methods. A. V. W.

PERSONAL.

O. P. Sells is designing a large power plant for electrolytic purposes for the Raritan Copper Works.

General Manager H. H. Brooks of the American Circular Loom company of Boston passed through Chicago last week on his return to Boston from a western trip. Mr. Brooks is one of those who enjoyed the Northwestern convention excursion. Afterward he proceeded West.

James G. Nolen, Jr., well known to everyone in the telephone trade, has severed his connection with the Western Telephone Construction company to accept a position with the Sterling Electric company, Chicago. Mr. Nolen has been one of the most active salesmen in the business, and the Sterling company is to be congratulated on securing his services.

Mr. W. F. Osborne, until recently the eastern manager of the Western Electrician, is receiving the hearty congratulations of his friends on the event of his marriage to Miss Emma Catharine Gale of Brooklyn on June 20th. Mr. and Mrs. Osborne are taking their wedding journey in the West, and this gave the western friends of the gentleman the pleasure of extending their felicitations in person.

The many friends throughout the West of J. A. Colby, manager of the Edison Light company of Des Moines, will be interested to know that he has recently severed his connection with that company. Mr. Colby has had extensive experience in central-station work, having been with the Des Moines Edison company for a period of nine years. Up to the present time Mr. Colby has formed no new connection, but his headquarters are for the present 237 Lake street, Chicago.

ELECTRIC LIGHTING.

It is said that the electric light is known among the Chinese of California as the "devil light."

The City Council of Los Angeles, Cal., has advertised for bids for an electric-lighting plant for the city, complete, with the exception of the generating machinery. The Los Angeles Lighting company owns the present system. About 640 lights are called for.

Modern improvements are being rapidly introduced in Alaska. The secretary of the Skaguay Light and Water company states that the waterworks are nearly completed and that an enormous power can be developed which will be utilized to form an electric-light plant, which will probably be in operation by fall.

A meeting of the Electricity Department of the Glasgow corporation was held recently, at which a report was presented by Mr. W. A. Chamen, chief electrical engineer, proposing that, in addition to the £55,000 to which the corporation already stands committed, a further expenditure of £61,000 be authorized for Port Dundas station and mains, and that an expenditure of £108,000 be authorized for the South Side station and mains.

ELECTRIC RAILWAYS.

Application has been made by the New Jersey Electrical Railroad company for a franchise to build from Camden to Atlantic City.

The Lock City railway has been transferred to the Buffalo and Lockport Railway company by Frank Haviland, who purchased it at foreclosure sale for $10,000.

The Market Street Railway company of San Francisco has filed a petition with the supervisors to change the cable system on Geary street to the overhead electric system.

It is reported that the Omaha Street Railway company is enlarging the capacity of its power plant to meet the heavy traffic expected during the exposition. Six new boilers, new engines and generators are being installed.

For the second time in the history of the Elgin Woman's Club the organization took charge of the lines of the Carpentersville, Elgin and Aurora Railway company, June 18th, "trolley day." The club is to have 60 per cent. of the gross receipts.

The Buffalo and Lockport Railway company is hard at work preparing to operate its line from Buffalo to Lockport. It is also building a new car barn in Lockport, adjoining the old Erie depot. This building will be of brick, 190 feet long and 55 feet wide. It will cover four tracks and furnish ample room to shelter a large number of cars.

Two-thirds of the stock of the Redlands (Cal.) Street Railway company has been owned for several years by the First National Bank. This stock has been purchased by Mr. Henry Fisher, president of the Southern California Power company. The Southern California Power company will be the greatest producer of electric power in the state in a few months, it is claimed, and will be able to operate the street-car line cheaper by electric power than it can be run by mules, which are now used.

Under the name Wisconsin Inland Lakes and Chicago railway it is proposed to carry out the Chicago and Wisconsin Inland Lakes project for a trolley line running from Chicago to Oconomowoc and Madison, Wis., and a number of intermediate summer resorts. The company's application for a franchise within the city limits has been favorably reported to the council from committee. The proposed line in Chicago will run from State and Kinzie streets northwesterly to a point between North and Armitage avenues, and thence westerly to the city limits, with a branch from West Forty-fourth street northwest to the city limits.

In Australia, too, it seems likely that the cable system will be superseded by electric traction on the street railways. A short time ago the minister of public works for New South Wales opened a new electric line to establish communication between the North Shore terminus of the cable system of Sydney and Willoughby, a northern suburb. The line cost $85,000. The power is supplied from the power house in Ridge street, there being also an accumulator house near the Flat Rock bridge. It is believed that eventually the cable system on North Shore will be supplanted by the electric system, which has proved more economical and given great satisfaction.

Three suits against the General Electric Railway company of Chicago were dismissed by stipulation in the United States Circuit Court last week. This action was due, it is said, to the company's franchises having passed into possession of the Chicago City Railway company. The principal suit was brought by Charles Austin Bates, who sought to prevent the company and Lucius Clark and others from disposing of 20,000 shares which Bates claimed as his property. The other actions were brought by Bates and

John B. Gleason, and had reference to shares, the possession of which was disputed by the company. Through the same argument, it is said, Judge Ball signed the final order which closes the litigation arising from the transfer of the lease on all the property and franchises of the company through Albert G. Wheeler to the Metropolitan Traction company.

A receiver for the Buffalo, Kenmore and Tonawanda electric railway has been appointed in the person of Albert C. Emmerick, who had been chief bookkeeper of the company. The receivership was brought about through the application of the Fidelity Trust and Guarantee company, which holds a mortgage of $55,000 against the railway company, upon which default has been made in the payments. The receiver is authorized to spend $5,000 on making repairs to the road. The court was made acquainted with the fact that, for the quarter ended September 30, 1897, there was a deficit of $1,993.99, and for the quarter ended March 31, 1898, there was a deficit of $2,353.93. Nothing has ever been paid on the principal of the mortgage, on which the interest has accumulated. The total deficit to July 1st is $58,329.53.

The Bloomington (Ill.) City railway, chartered in 1888, has been sold at auction for $202,500. The plant consists of 13 miles of track, comprising the main line connecting Bloomington with Normal, four miles in length, and a system of branch lines in Bloomington. The line was bought by a local syndicate, at the head of which are John Eddy and A. E. Demange of Bloomington. John Graham of Philadelphia, holder of the second-mortgage bonds, is in the syndicate. The plant was covered with three sets of mortgage bonds, the total investment in the road, as represented by the bonds, being over $400,000. The affairs of the company have been in litigation for some years, through contentions between the three sets of bondholders. The plant, it is stated, is in bad condition, and it will take $50,000 to reconstruct it.

TELEGRAPH.

The Canadian Pacific copper telegraph line, from Montreal to Vancouver, B. C., has been strung in three divisions—to Fort William, thence to Donald, B. C., thence to the coast. A great deal of trouble has been experienced by telegraphic companies by reason of wires coming in contact with each other, through the breaking of the glass insulators by which the wires are attached to the poles. A test was therefore made at McGill University, Montreal, with a view to ascertaining the comparative resistance of glass and porcelain insulators, with the result that it was found that porcelain resisted much heavier and a greater number of blows than the glass. The testing of the wire was done at the Applied Science Department of McGill from samples taken at random from bundles of 10 as they are manufactured by the Dominion Wire company. The wire must be .137 of an inch in diameter, perfectly cylindrical and weigh 300 pounds to the mile—four pounds of variation being allowed in this distance. Frequent electrical tests are made upon pieces one one-hundreth of a mile in length, to determine the purity of the copper used, which must be 97 per cent. Each bundle weighs 170 pounds, and the wire must be in one continuous length, without joint or break. Each six inches of wire will stand 50 twists of one twist a second before breaking and an average breaking strain of 970 pounds, and will stretch one per cent. before breaking.

POWER TRANSMISSION.

J. W. Scott, an enterprising citizen of Napanee, Ont., has closed a contract with the Canada General Electric company for a 100-kilowatt, 4,000-volt, three-phase generator of the revolving-field type, for the purpose of supplying light and power to the town of Napanee from a water power eight miles distant from the town. He will also supply light and power to intermediate points.

The Pelton Water Wheel company has been awarded the contract for the hydraulic work for the new plant of the Central California Electric Power company, to be installed at Auburn, Cal. This station is to embrace two 43-inch wheels, to run under 200 feet head at 300 revolutions and develop 300 horse power. The wheels are to be direct-connected to a 500-kilowatt Westinghouse generator, which is to be electrically coupled to the generators running the Newcastle station of this company, six miles distant, and the power transmitted to Sacramento over the same pole line. The entire distance from the Auburn station is 34 miles. The interesting features of this plant consist in running two stations so far apart in parallel and in the double use of the water, it being the same as supplies the Newcastle station six miles lower down.

The work on the power development at Massena, N. Y., has been delayed some little time, owing to the action of the Lehigh Construction company in discontinuing operations. Now the St. Lawrence Construction company has awarded the contract for the completion of the canal to the T. A. Gillespie company of Pittsburg, Pa. The Gillespie contract calls for the completion of the canal excavation, the construction of all masonry, power house, building of piers, and the erection of railroad bridges across the Racquette and Grasse rivers, within two years. It is stated that the Gillespie company is one of the largest contracting firms in the country, having about 2,400 men on its various payrolls. About 1,000 men will be engaged on the Massena work. Steam shovels and scrapers will be at once put to work. The prospect of the canal being completed has aroused a joyous feeling in Northern New York.

ELECTRICAL SECURITIES.

The Westinghouse Electric and Manufacturing company has declared a quarterly dividend of 1¼ per cent. on its preferred stock, payable July 1st.

The Edison Electric Illuminating company of New York reports gross earnings for May of $246,794, an increase of $58,004 as compared with the same month of last year, and net $106,789, an increase of $24,094. For the five months ended May 31st the gross earnings were $1,326,567, an increase of $270,661 as compared with the corresponding period of last year, and net $605,772, an increase of $97,263.

MISCELLANEOUS.

The San Bernardino (Cal.) Sun relates that during a recent house-moving in that place several high-tension wires, crossing the street, were encountered. A man was sent on top of the building to lift the wires over the chimney. In doing this he stepped on some of the wires and took others in his hands to lift them over, when he received the full force of the 1,100 volts. He fell unconscious and rolled down the roof and would have fallen to the pavement, but he caught in the wires. His fall broke the contact, but when rescued from his perilous position he was still unconscious. He was taken home and resuscitated, and was improving at the last account.

TRADE NEWS.

Mr. C. L. Mullinix, formerly with the Ohio Electric Specialty company at Troy, O., having disposed of his interest in that concern, has organized in Cincinnati the Mullinix Electric company, to manufacture electrical specialties. Mr. Mullinix was the designer of the Perfection dynamo brush and several other well-known specialties in the electrical line. The Perfection brush has been improved, it is said, and will be known hereafter as the Mullinix dynamo brush. The company will also manufacture the ordinary types of woven-wire brushes, both of copper and alloy, and also the leaf-copper brushes.

An assignment to the Chicago Title and Trust company was made on Monday by the Western Rubber Belting company, 205 Lake street, Chicago. Judge Carter ordered the assignee to continue the business of the firm, and it is believed the latter's troubles are only temporary. The assets are estimated at $140,000 and the liabilities at about $128,000, of which $3,200 is owing to Chicago firms and individuals. The assignment grew out of the complications of the Boston Woven Hose and Rubber company, which failed last week, and for whose products the Chicago firm acted as distributers in the West.

All practical men who are familiar with it admire the work of the International Correspondence Schools of Scranton, Pa. Everything sent out from the establishment shows complete and easy mastery of the subject under discussion as well as exact thoroughness in detail. A word of praise is also due to the beautifully clear character of the printed matter and illustrations. The institution is a large one, employing over 500 persons, and seems to be admirably managed. One secret of its success is the employment of first-rate, experienced men as instructors. A recent pamphlet, issued from the press of the establishment and of excellent typography, announces that, "in their perfected form, our instruction papers, or textbooks, are now for the first time brought to the attention of engineers and others interested in technical education." This is a fact of interest to many engineers—electrical men among others—and the little book telling of the schools and their technical books is well worth reading. Doubtless it can be had for the asking.

The American Electric Vehicle company has been reorganized, and with a large infusion of new capital it proposes to expand its business on a large scale. A number of gentlemen connected with the Indiana Bicycle company have secured the controlling interest, and stand prepared, it is said, to put no less than $300,000 in the business. The principal office has been removed to Indianapolis, where the factory of the Indiana Bicycle company is located, but the Chicago office and showroom at 1545 Michigan avenue will be retained. Such additions as will be necessary will be made to the large factory of the Indiana Bicycle company to handle the electric-carriage business, and 100 vehicles will be made up at once. Afterward the plant will have a capacity to build from 10 to 50 vehicles a day, if necessary. The company will manufacture two styles of vehicles for the regular trade. One will be a light runabout and the other a merchandise delivery wagon. The company will also make small brakes, traps and broughams for special orders. Every part of the vehicle will be made at the factory in Indianapolis except the wagon-beds. For these the company has no machinery as yet, but it is probable that a bed factory will be added. The new officers of the company are: President and general manager, C. F. Smith; vice-president, Philip Goetz; secretary, L. S. Dow; treasurer, C. J. Bechard. These gentlemen and C. E. Corrigan constitute the board of directors. Mr. Corrigan, who will remain in charge of the Chicago office, will become interested of the success which now seems bound to attend the company. He has been prominent in the thankless task of pioneering the electric-carriage industry, and has made such a showing by hard and patient work that the needed capital to push the business in a manner commensurate with the field before it was secured.

BUSINESS.

The Phosphor-bronze Smelting company of 2200 Washington avenue, Philadelphia, has issued a new price-list in compact and convenient form. The company makes the "Elephant brand" of phosphor-bronze and also Delta metal.

The Jandus enclosed arc lamps, for use on all systems, are being ordered in large quantities through the Chicago office of the Jandus Electric company, 753 Monadnock building. The new publication, "The Midnight Sun," is sent on request.

William Roche of New York, manufacturer of the "New Standard" dry battery, states that in view of the fact that Uncle Sam is rushing him on his A No. 1 cell, there must be merit in his product. The "New Standard" is said to be particularly adapted for telephone service.

A handsome pamphlet, with attractive cover printed in colors, shows some of the isolated electric-lighting plants having Walker dynamos. The first one illustrated, that of the Waldorf-Astoria Hotel in New York, is said to be the largest isolated lighting plant in the world.

The M. C. Bullock Manufacturing company of Chicago reports a steadily improving business. Its total shipments for the month of May in this year were larger than for any one month since the financial stringency began in 1893. Some of the machinery went to Japan and some to Siberia. The Bullock company makes mining machinery and the Willans central-valve engine.

The Buckeye Electric company calls the attention of central-station managers to the special coiled filament used in the Buckeye incandescent lamp. At 3.5 watts efficiency, used at normal voltage, this filament is said to produce an average of 16 candles for 600 hours. The western office of this company is at 753 Monadnock building, Chicago. Catalogue and prices are sent on application.

To those who contemplate taking a summer outing, the Detroit and Cleveland Navigation company will mail for two cents postage an illustrated pamphlet, which contains a large number of fine engravings of summer resorts between Cleveland, Toledo, Detroit and picturesque Mackinac. It has many artistic half-tones of points of interest of the Upper Lake region. Information regarding both short and extended tours, costs of transportation and hotel fare, etc., is supplied by A. A. Schantz, general passenger agent, Detroit, Mich.

A firm may gain temporary advantage by sacrificing everything to cheapness; there is no profit in it in the long run, and it is demoralizing to the trade. Cheap, inferior goods are dear at any price, and every engineer knows that this particularly applies to sheet and piston packings, gaskets, etc. The Garlock Packing company of Palmyra, N. Y., has always maintained a high standard of excellence in the manufacture of its productions. All of its packings are of high grade, and have been favorites with engineers for the last 18 years.

W. S. Tobie's Eclipse cut-out for telephones is a well-made device, with an especially long switch lever, giving exceptional distance between the telephone and line-circuit connections when the instrument is cut out. The ground wire on the base of the cut-out is placed about one-sixteenth of an inch from the line wire, to carry off an extra heavy charge. In some cases it will save the telephone if the operator forgets to turn the lever off. This cut-out is described as "a sure cure for burn-outs." All connections are soldered, and it is mounted on an oiled wooden base. W. S. Tobie of Augusta, Ill., is the maker.

There has been a growing demand among belt users for a more convenient form of belt dressing than the paste. The Joseph Dixon Crucible company, Jersey City, N. J., is now placing on the market a solid belt dressing in round bars, about eight inches long and two inches diameter. It makes a package convenient to the hand, and easy to apply even to fast-running belts. The company does not claim that the solid dressing is as good a preservative of the life and elasticity of the leather as the Dixon paste, but it is quick to apply and quick to act, and that is what is wanted by the general run of belt users.

The Central Electric company of Chicago is carrying in stock an improved type of turnbuckles, both galvanized and plain, which can be furnished with hook and eye, double-hook or double-eye. These goods are standardized and constructed with a view of great strength being secured. The same company is now pushing to the front a new type of standard-base six candle power lamp. This lamp is

made for standard voltages, is 3½ inches over all, and about two inches in diameter. It is exceedingly economical of current and will undoubtedly find very popular use for signs and other purposes where low candle powers are desired.

The United Gas and Improvement company of Philadelphia, Pa., is making extensive additions to its gas-producing plant. At the Twenty-fifth Ward gas-works it is building a new scrubber house 45 feet wide and 120 feet long and a purifier house 86 feet wide and 180 feet long. At the Point Breeze works it is erecting a new boiler and engine room 220 feet long and 55 feet wide, a condenser building 40 feet wide and 105 feet long, a purifier building 86 feet wide and 180 feet long, a generator house 100 feet wide and 184 feet long, a meter house, with additions for exhaust and valve room, having a width of 70 feet and a total length of 223 feet. All of these buildings are of steel frame construction, brick side walls and slate roofs supported on metal purlins carried by clear span trusses. All the structural steel work for this extensive plant is being furnished and erected by the Berlin Iron Bridge company of East Berlin, Conn.

The Beattie Zinc Works company of Reading, Mass., has been in the field for nearly 10 years, during which time it has built up one of the largest businesses in the country for battery zincs of all kinds. While these goods are in especial demand for fire-alarm and police-signal systems the electrical fraternity in general use them very extensively, and the demand is increasing daily. The makers claim them to be superior to anything on the market. Being thoroughly amalgamated, these zincs are said to effect a greater saving and to show a higher efficiency than any other kind in use. These zincs are said to produce a strong, durable and uniform current, which maintains its electromotive force until the zinc is entirely consumed, and gives an internal resistance of only one-half that of common zincs; they do not honeycomb or become coated with a hard incrustation, it is claimed, the action being even and uniform, and the deposit, which is porous, is easily shaken or wiped off, effecting a large saving in zincs, cells and care.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued June 21, 1898

605,835. Electrolytic Production of Amalgams, etc. Emile Andreoli and Gabriel Andreoli, London, England. Application filed September 17, 1895. Patented in England August 9, 1895.

An apparatus for the production of amalgam consisting of a cell provided with positive and negative compartments separated by porous diaphragms, the negative compartments having a raised middle portion in the form of a table or block, between the sides of which and the partitions are narrow vertical spaces, the top of the block or table and the vertical spaces being covered and filled with a continuous body of mercury forming a cathode.

605,842. Electrically Heated Charge for Cartridges or Shells. Lindon W. Bates, Chicago, Ill. Application filed June 30, 1896. Renewed November 18, 1897.

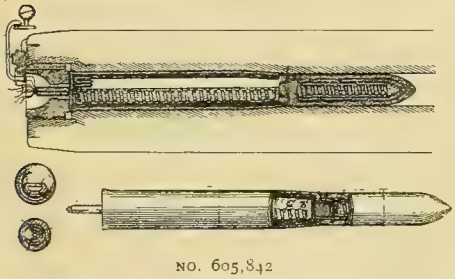
A prepared charge or cartridge for guns and ordnance is composed of an outer and an inner shell or casing, an intermediate insulating substance, an electric heater, a differential valve mechanism for sealing and unsealing the chamber within the inner shell, a liquid chamber in the rear of the larger valve and a valve-controlled vent for the liquid chamber, whereby the liquid may be retained within its chamber and the valves held to their seats until the requisite pressure is attained within the shell or chamber, and then released.

605,850. Electric Motor. Frederick E. Briner, St. Louis, Mo. Application filed August 21, 1897.

The armature for induction motors described comprises an elongated core, and induced-current conducting bars whose ends are bent one upon the other, the ends interlocking with each other.

605,862. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed May 20, 1897.

An electric meter is provided with a cylindric armature, a shunt-field within the armature and a series field without the armature comprising separate horseshoe-shaped cores partially embracing the armature and series coils wound upon the cores.



NO. 605,842

605,913. Telephone Transmitter. Forest A. Ray, Boston, Mass. Application filed August 18, 1897.

Provision is made for a cell for comminuted resistance-varying material, comprising a flattened ring of soft spongy material, the comminuted material to be contained within a narrow oblong space having one or more upright extensions.

605,915. Electric Clock-controlled Switch Mechanism. Robert W. Rollins, Hartford, Conn. Application filed September 27, 1897.

The clock controls a pair of electric circuits and embodies a driving arbor and two independently regulable circuit-controlling mechanisms mounted on the arbor and insulated from each other, one for each of the circuits.

605,941. Electric Block-signal System for Railways. Louis C. Werner, Broad Brook, Conn. Application filed July 22, 1897.

Claim is made for the combination, with a track having a sectional conductor forming insulated blocks, of vehicles movable along the track and electrical recorders, one for each block, and each embodying a primary recording device in a circuit controlled by the block, and a separately operative secondary recording device in another circuit controlled conjointly by the primary recording device and by the block.

605,949. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Application filed June 24, 1897.

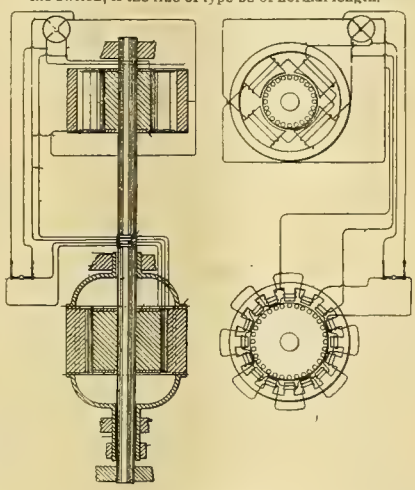
An electric meter is provided with a cylindric armature, a series field without the armature, and a shunt field within the armature comprising a cross-shaped core, and shunt coils upon the core.

605,953. Controlling Mechanism for Electric Motors. George Gibbs, Warren S. Johnson and Henry Winkenwerder, Milwaukee, Wis. Application filed May 10, 1897.

The mechanism includes a rheostat comprising resistance and a movable arm for bringing more or less of the resistance into circuit, a fluid motor for operating the rheostat arm consisting of a cylinder provided with a piston which is connected with the arm, two reservoirs connected with opposite ends of the cylinder and each having an air supply and waste connection, and valve mechanism controlling an air connection of each reservoir.

605,956. Controller for Type-casting and Setting Machines. George A. Goodson, Minneapolis, Minn. Application filed January 25, 1897.

The electrically operated type-casting and setting machine is equipped with an electric controller in the supply or working circuit, and circuit connections for the controller, including a pair of contacts normally separated to open the controller circuit during the casting action, but which engage to close the controller circuit, at that point, during the line delivery action, and a switch, operated by the type-delivery devices, for co-operation with the pair of contacts to close the controller circuit if the line of type be of other than normal length, and to open the controller circuit, at the switch, if the line of type be of normal length.



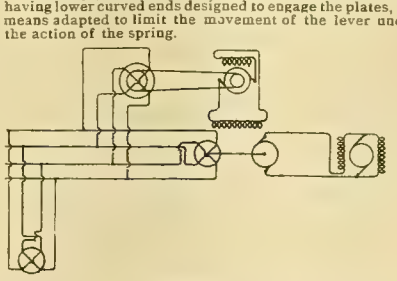
NO. 606,056.

605,957. Differential Letter-space Register for Composing Machines. George A. Goodson, Minneapolis, Minn. Application filed January 25, 1897. Renewed March 31, 1898.

The bank of keys controls electric devices adapted to variably set the driver against its actuating spring when the keys are depressed and for variably feeding the movable part of the indicator when the keys are released.

606,004. Thermal Circuit Closer. Lionel Emdin and John A. Dewson, Reading, Pa. Application filed November 19, 1897.

The automatic fire-alarm described comprises a base having a series of plates secured thereto and in circuit with the alarm system, a lever pivoted to the base and also in circuit with the alarm system, a spring designed to actuate the lever, a fusible block having a shoulder designed to engage and hold the lever in a normally raised position, the lever being provided with depending arms or members having lower curved ends designed to engage the plates, and means adapted to limit the movement of the lever under the action of the spring.



NO. 606,015.

606,069. Electric Controller. Marshall W. Hanks, Madison, Wis. Application filed December 17, 1897.

A contact cylinder is mounted on a rotatable shaft, a second shaft is provided with actuating means and mechanism, interposed between the actuating means and the contact cylinder, comprising a projecting part on the cylinder shaft engaging with a spring on the second shaft, whereby the contact cylinder may be instantaneously rotated, in either direction, to its consecutive positions regardless of the velocity of the actuating means.

606,012. Electric-current Controller. John J. Hogan, New Haven, Conn. Application filed July 15, 1897.

There is described the combination with an operating shaft carrying a resistance coil, of a carriage movable in a plane parallel with the axis of the shaft and carrying a contact finger which engages the coil, a screw-feeding mechanism and a rack-and-pinion feeding mechanism, both of which are actuated by the operating shaft, and means for interchangeably connecting the carriage to the feeding mechanisms, whereby either mechanism can be utilized to impart movement to the carriage.

606,015. System of Electrical Distribution and Regulation. Benjamin G. Lamme, Pittsburg, Pa. Application filed February 10, 1898.

A system of distribution comprising a direct-current generator, a rotary transformer receiving current therefrom and supplying alternating currents to translating devices, a generator for exciting the field-magnet of the rotary transformer and means dependent upon changes in the amount of inductive load on the alternating-current circuit or circuits for automatically varying the speed of the exciting generator.

606,033. Means for Compensating for Temperature-resistance Changes. Charles F. Scott, Pittsburg, Pa. Application filed January 21, 1895.

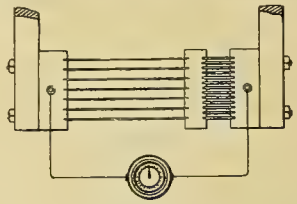
In an indicating instrument for alternating currents, the combination with the rotable closed-circuit armature of two actuating circuits in inductive relation to the armature and containing non-inductive resistances, one of which has a greater value and a higher temperature resistance coefficient than the other.

606,056. Alternating-current Electric Motor. Robert H. Hassler, Pittsburg, Pa. Application filed September 6, 1895.

The method of regulating the speed of rotation of a shaft or axle consists in subjecting it to the resultant torque of two rotating magnetic fields having a different number of poles for one rate of speed and changing the direction of rotation of one of the fields for a different rate of speed.

606,076. Electric Alarm System. Albert Ovenden, Akron, O. Application filed September 24, 1897.

A circuit closer for an electric alarm, comprising a plurality of inclined ways superimposed and independent of each other, extending in opposite directions and having conducting and non-conducting portions, a roller circuit closer, hoppers at the upper and lower ends of the inclined ways, and a movable elevator to receive the roller-circuit closer from the lower hopper and to deliver it to the upper hopper.



NO. 606,171.

606,108. Electric-arc Lamp. Frederic Wright, Newburg, N. Y. Application filed October 7, 1897.

An arc lamp, comprising a casing, carbon magazines mounted on the casing, carbon-holder tubes extended from the magazines and converging, carbon-locking plates on the tubes, and means for automatically operating the plates.

606,127. Electrode for Arc Lights. Charles S. Dolley, Philadelphia, Pa. Application filed November 21, 1896.

An electric-arc electrode for use in connection with electric-arc lamps is described, consisting of calcium carbide, of size, shape and resistance proportionate to the amount of current used.

606,162. Telephone-exchange System. William W. Dean, St. Louis, Mo. Application filed February 6, 1897.

In a telephone system, the combination is claimed with a telephone line extending from an exchange to a plurality of substations, of a plurality of positively and negatively polarized bells and electromagnets connected therewith located at the substations, mechanical means controlled by the electromagnets for preventing the actuation of the bells, and means at the central office for including the electromagnets in circuit with direct current of positive or negative sign, and including the bells in circuit with ringing current of positive or negative sign.

606,167. Electric Brake. Ernst W. G. C. Hoffmann, Charlottenburg, Germany. Application filed December 29, 1897. Patented in Germany April 14, 1896.

A dynamo is suitably mounted to be driven by the movement of the controlled wheel or wheels; an electromagnetic brake appliance is connected with the dynamo; a controlling circuit is provided, and an electromagnetic controlling device is connected in the circuit adapted to secure the transmission of current from the dynamo to the brake appliance when the device is actuated.

606,171. Shunt for Electric Circuits. Oliver B. Shallenberger, Rochester, Pa. Application filed April 22, 1897.

An electric shunt comprising two groups of conductors which have different temperature coefficients.

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Illumination of the Trans-Mississippi Exposition.

The central feature of the Trans-Mississippi and Internation Exposition at Omaha is the illumination of the Grand Court, about which are gathered the principal buildings. This is conceded to be the crowning feature of the exhibition, and nightly attracts throngs to the scene.

The Grand Court is about half a mile long, extending from Sherman avenue on the east to Twenty-fourth street on the west. It has a depression 150 feet wide throughout the greater length, and in front of the Government building at the west end it broadens out to a width of 400 feet. This depression is occupied by a lagoon, the west end forming a three-lobed lake which is picturesquely termed the Mirror and containing the electric fountain. Extending from the Government building toward the east on either side of this lagoon are colonnades leading to the Fine Arts building on the south and the Agricultural building on the north. Beyond these are the Manufactures, Machinery, and Electricity buildings on the north side of the lagoon, and facing them from the opposite side are the Liberal Arts, Mines and Mining buildings. At the eastern end of the court is a great hemicycle stairway leading to the esplanade, beyond which are the twin restaurants, two ornamental structures with irregular spires, which complete a very pleasing setting for the picture. About halfway down the basin is an island with bridges connecting it to the shore on each side. On the south side of the Grand Court at this point is the Arch of the States, which is probably the handsomest specimen of architecture on the grounds, and across the lagoon is the Administration building. The buildings, bridges, colonnades, statuary and ornaments of all kinds are covered with staff and have been given an old ivory tint, much the same as the World's Fair buildings, and this enabled the management to produce lighting effects and night scenes that would be impossible otherwise.

This explanation of the general conception of the Grand Court and the arrangement and relative position of the buildings will enable the reader to appreciate at a glance the birdseye view presented in the photographic reproduction of the scene on page 19. This view was taken from the extreme eastern end of the Grand Court, overlooking the esplanade, and affording a commanding sweep of the entire basin to the Government building, at the opposite end of the court. As may readily be imagined from the picture, the scene presented is one of great beauty. It is impressive by day and awe-inspiring at night, and the universal opinion of visitors, especially those of experience in similar undertakings, is very complimentary to those who designed and executed the work.

The illumination of the Grand Court presented a difficult problem. The management desired to avoid anything that might be construed as imitation of the World's Fair, and, at the same time, secure a pleasing effect. It should be borne in mind that the buildings surrounding the Grand Court at Omaha are not as large as those which faced the Court of Honor at the World's Fair, and that there were several other features which precluded the adoption of the plans followed in Chicago.

Luther Stieringer, to whom this matter was referred, determined at once upon an entirely new plan. In the first place he eliminated arc lighting entirely from the problem and depended solely upon incandescent lamps. This was a radical departure, but the result justified the change. Another feature of Mr. Stieringer's plans was the absence of any attempt at decorative lighting. He decided to adopt a system that would secure an almost perfect distribution of light. To accomplish this it was necessary to harmonize many conflicting elements, which could only be done by careful study of the local conditions. The experience of former illuminations was of little value, and that only of a negative character, merely serving as a warning against certain errors and omissions, and affording but little opportunity for comparison or suggestion. In some respects, however, it furnished unrivaled advantages, and no one will deny that Mr. Stieringer has made the most of the conditions as he found them. The only restriction imposed by the management was in the matter of expenditure, which, of course, had to be kept within the limits of the resources of the exposition. The only feature of the plans that might be construed as decorative lighting is in connection with the operation of the fountain at the west end of the lagoon before the Government building, but this cannot be strictly classified as an electric fountain, although it is generally referred to as such.

The illumination of the court is accomplished by the use of incandescent lights arranged in clusters and groups upon artistically designed poles and Corinthian columns, and rows of single lamps along the cornices of the buildings, on the bridges, pillars and domes, outlining the beautiful structures and diffusing a soft, mellow light over the entire scene. The chief attraction of the plan adopted is the absence of everything harsh and trying. Sharp contrasts are avoided. There is no glare, neither are there any deep shadows. The scene is restful, almost subdued, and one cannot fail to recall the Court of Honor at the World's Fair. The Grand Court at Omaha invites comparison.

Critical examination of the details of the plans for lighting the Grand Court reveals many minor innovations that might be studied with good results by those engaged in public lighting and in the illumination of large pavilions and extensive arenas of all descriptions. By reference to the illustrations it will be noticed that an ornamental railing surrounds the lagoon, and that at regular intervals the posts of this railing are extended and utilized as supports for clusters of lamps. These clusters are seven feet six inches above the ground. Between the railing surrounding the lagoon and the building line is arranged a second row of posts. These are nine feet and 10 feet high, according to location, and they, too, are surmounted by clusters of incandescent lamps. The row of lights along the cornices of the buildings forms the third tier, and, beside outlining the structures, contributes greatly to the general illumination. The effect produced by this arrangement of lights, one tier above another, is very pleasing. The white buildings are distinctly outlined against the background, and the reflections in the lagoon are indeed picturesque, especially upon a dark night.

Viewed from any point along the lagoon the night scene in the Grand Court is really inspiring. There are many favorite locations, and the pictures accompanying this article are photographic reproductions of the views secured by observers at these points. One was taken from the esplanade at the extreme east end of the lagoon, and includes the entire court.

ILLUMINATION OF THE TRANS-MISSISSIPPI EXPOSITION.—GRAND COURT, LOOKING EAST FROM ESPLANADE; GOVERNMENT BUILDING AND FOUNTAIN IN THE DISTANCE.

Another is a view of the western end of the court from the island already mentioned. A third view shows the east end of the court. There is also presented a view of the fountain illuminated only by the beams from searchlights on either end of the Government building. All of the incandescent lamps had been turned out before this picture was taken.

In all of these views, with the single exception of that showing the ornamental towers at the east end of the court, the Government building is a conspicuous feature. It is the most imposing structure on the grounds, and, because of its commanding position and graceful lines, is really the central figure in the illumination. The building partakes of the classic style, the Ionic order being closely followed. It is arranged in three sections, that at the center having a frontage on the lake of 208 feet and a height to the top of the balustrade over the cornice of 58 feet. It has a depth of 150 feet. The main entrance faces the center of the basin, and is reached by a broad flight of steps and through a colonnade. This entrance is flanked on either side by pavilions capped by richly decorated domes. The main building is surmounted by a colossal dome which towers far above all the other buildings, and is capped by a heroic figure representing "Liberty Enlightening the World." At night this figure is lighted by electricity, the torch being 178 feet above the ground. The side sections, which are separated from the central portion of the building by colonnades connecting with the Agricultural building on one side and the Fine Arts building on the other, have each a frontage of 148 feet, being 100 feet deep and 44 feet high to the top of the balustrade. This makes the total length of the building 504 feet. As may well be imagined, this building presents an excellent opportunity for securing striking effects without departing from the harmony of the general plan. The salient architectural points are brought out, and the illumination of the figure of Liberty commands attention. Beneath the figure several lines of light completely girdle the cupola above the dome. Streamers of light cover the dome, apparently held in place by five-pointed stars on either side of the dormer windows. Below these another line of light completely surrounds the base of the dome. Arising from the roof of the central portion of the building, a series of lamps supported on shafts of artistic design illuminate surrounding objects. The allegorical figures on the upper cornices and flanking the dome are outlined harmoniously and effectively.

Looking down the court from the Government building, the Fine Arts building at the right first attracts attention. Here, too, the domes are light-encircled, the cornices ablaze and pillars illuminated. Across the lagoon the classical lines of the Agricultural building are picked out in incandescent lamps, the upper portions, including the balustrades, the corner towers and the main entrance, being clearly revealed. The lofty spire of the Administration arch, the distinctive feature of that building, is traced in lines of light. In the Manufactures building, all the prominent roof cornices, caps of columns, pedestals and other features are distinguished in like manner. Across the lagoons the Arch of the States is girdled with bands of light and the Liberal Arts building is outlined along its cornices. The Mines and Mining building is especially adapted for effective lighting, and its graceful portico is clearly defined, while the towers wear crowns of incandescent lamps and the windows shine brilliantly on the scene. Facing this structure is Machinery and Electricity building penciled in light. The east end of the lagoon, in front of the last two mentioned buildings, in company with the adjacent terraces, landings and broad viaducts leading away from it, is illuminated by incandescent lamps supported by fanciful standards of special design. The result obtained by the use of 15,000 incandescent lights, distributed as already explained, is effective and artistic, and is certainly the most attractive feature of the entire exhibition.

In the Mirror lake at the west end of the Grand Court, as already mentioned, there is a fountain designated Nautilus and generally referred to as an electric fountain. It is a very attractive feature, but is not in the strict sense of the term an electric fountain. There are incandescent lamps in the water near the jets, but the colored light is furnished by projectors at the corners of the Government building. The operators have succeeded in effecting combinations of colors that are not generally seen in electric fountains, and this, of course, is an advantage that is fully appreciated. The fountain itself is an attractive feature of artistic design. In the center is a tall column, on the top of which is seated the figure of Neptune, looking down upon the waters playing about him in vari-colored streams, shooting hither and thither and casting their spray in every direction.

Details of construction of the fountain are shown in the view of the Grand Court, looking east, which is presented on page 18. This picture was taken before the water had been turned into the basin. At present the jets in the fountain are on a level with the water in the lagoon, and when the fountain is playing the effect produced resembles that of a geyser. This view presents an excellent picture also of the art poles used for supporting the clusters of incandescent lamps about the Grand Court.

The pictures presented on pages 15, 16, 17 and 18 are reproductions of photographic views of night scenes, and another on page 19 shows the fountain to advantage. These photographs were taken especially for the Western Electrician and pronounced by Mr. Stieringer, the consulting engineer who designed the illumination of the Grand Court, and Mr. Rinehart, the official photographer of the exposition, the best representations of the scenes that have been secured. The Western Electrician is indebted to Mr. Stieringer and Mr. Henry Rustin, the superintendent of lighting and power, for valuable assistance in securing these excellent views.

ILLUMINATION OF THE TRANS-MISSISSIPPI EXPOSITION.—VIEW OF GOVERNMENT BUILDING, FOUNTAIN AND MIRROR LAKE FROM ISLAND.

Recent Scientific Achievements.

A contributor to La Nature remarks that the best reply to the attitude toward modern science of certain critics who profess to make light of what they call its pretensions, and who magnify its failures, is to enumerate some of the wonderful discoveries and inventions of the last few years. This (to quote the translation of the Literary Digest) he does in the following interesting recital:

"Suppose that a man had fallen into a trance just after the closing of the exposition of 1889, that is, less than nine years ago, and consequently knew nothing of the progress that has been made since that time, up to the period of our next great international manifestation. His admiration and his study would be devoted to the following objects:

"1. The bicycle, which is revolutionizing our habits, and which existed in his time only in rare specimens, bulky indeed, compared with the little queen of our day. 2. The horseless carriage, moved by petroleum or electricity, whose future is perhaps even more promising than that of the bicycle. 3. The electric railways, which scarcely existed in 1889 and which will modify in the next century the conditions of working of the great trunk lines. 4. Polyphase currents, which enable us to transmit and distribute natural motor forces at great distances. 5. The Laval steam turbine, a new process—from the industrial standpoint—for utilizing steam at high pressure. 6. The interior-combustion motor of M. Diesel, which is the most economical means now known for transforming heat into work. 7. Calcium carbide, which gives rise to acetylene, one of the illuminants of the next century. 8. The cinematograph, with which we have been recently filled with wonders to the point of saturation. 9. The Röntgen rays, which are revolutionizing the healing art. To these nine discoveries or great inventions, whose results are already ours and whose benefits we enjoy daily, we may add: 10. Liquid air for industrial purposes. 11. Color photography, in which the latest results of the Messrs. Lumière have just been presented to the Academy of Sciences by M. Mascart. 12. Wireless telegraphy, a process full of promise. 13. Cold light, obtained by luminescence of rarefied gases, traversed by the electric current. 14. High-frequency currents, with which Tesla and D'Arsonval have conducted such marvelous experiments.

"In less than 10 years, solely in the domain of mechanics and physics, we have 14 new sensational discoveries which are to be added to the already long list of the scientific conquests of the nineteenth century, and which we should have to explain to our sleeper on his awakening."

Present Status of Electrical Engineering.[1]

By Dr. A. E. Kennelly.

While mechanical engineering may be said to have an antiquity coeval with civilization, its latest offshoot, electrical engineering, only came into existence with the advent of the electric telegraph some 60 years ago. For the greater part of this time electrical development was confined to the telegraphic industry, but, with the extended introduction of the arc and incandescent lamps, the utilization of the magnetic properties of iron and steel made rapid progress in dynamo construction, so that the magnetic properties of steel now play almost as important a part in the advance of civilization as do their mechanical properties.

By far the greater proportion of electric development has come within the last decade and a half. Looking back from the Trans-Mississippi Exposition at Omaha of to-day to the International Electrical Exhibition of Philadelphia in 1884, the birthplace of the American Institute of Electrical Engineers, it is doubtful whether outside of telegraphy and telephony there was at that time in the United States a total investment of $1,000,000 in electrical applications. The words ammeter and voltmeter were just commencing to be generally recognized, and of electric traction there was none. At the present time the capitalization in electrical applications in the United States is estimated at about $1,900,000,000.

In 1884 a 50-kilowatt dynamo was considered a large machine, while a 100-kilowatt Edison steam-dynamo was justly called a "jumbo." At the present time the largest size of generator built or building is of 4,600 kilowatts capacity. The price of dynamos in 1882 was about 20 cents per watt of output, while dynamos of similar running speed in comparatively small sizes, without switchboards, now cost about two cents per watt. The great reduction in price represents the aggregated result of the very large amount of labor devoted to this branch of engineering in the last 15 years.

It is interesting to notice that the efficiencies of continuous-current dynamos have not made any marked nominal advance since the birth of the Institute, though their output per unit of mass has considerably increased. Thus the 50-kilowatt dynamo tested at the Philadelphia Exhibition is stated to have had an efficiency of approximately 92 per cent., and this would be considered a satisfactory performance in that size of machine to-day. But, where the output then was only six watts per pound of net weight (13.2 watts per kilo) the output of a machine of similar rating and speed to-day would be about 10 watts per pound (22 watts per kilo). In other words, the efficiencies of the best dynamos of 1884 were already so good that it has not paid, at existing costs of power, to markedly improve them, and such improvements in material and design as have since been effected have enabled manufacturers to increase the rating or yield, and, therefore, the cheapness of the machines. It seems probable, moreover, that this will continue to be the direction of future progress. We scarcely can desire more efficient machines than the best we have now, but we shall always desire cheaper and more powerful machines, and shall welcome any improvements which lead to them.

Another evidence of the development in dynamo machinery is their improved appearance. Formerly, the only claim possessed by such apparatus was utility. More recently, grace, the expression of unconscious power, has supervened, and the modern dynamo is often pleasing to look upon as well as useful to operate.

The cost of generating a kilowatt-hour of electric energy from steam for electric lighting appears to have been at least 7.5 cents at bus-bars in 1884. At the present time the cost of delivering a kilowatt-hour to large street-railway systems from steam is only about one cent, and the power-house operating costs are reported in some cases as low as half a cent. In municipal electric-lighting systems, supplied at low pressure from steam central stations and hampered by relatively heavy distributing expenses, the retail price of the kilowatt-hour varies from 20 to about 4½ cents, according to the locality and quantity consumed. Niagara power is now sold to consumers in Buffalo at rates varying, according to the amount delivered, from two cents to slightly less than two-thirds of a cent per kilowatt-hour delivered.

The price of a 16 candle power incandescent lamp 16 years ago was about $1. Now it is about 18 cents. The best lamps at that time, under laboratory conditions, gave about 0.28 mean horizontal normal British candle power per watt, and under commercial conditions about 0.20. The highest pressure for which they could then be obtained was about 110 volts. At the present time lamps are obtainable giving normally 0.4 mean horizontal British candle per watt, while under commercial conditions the average lamp normally develops about 0.25 candle per watt. They can also be obtained (at 0.25 candle per watt) for pressures up to 240 volts, and are frequently installed on 220-volt mains.

Arc lamps were already so far advanced in 1884 that comparatively little improvement in their effectiveness has taken place, the gain having been made in economy of operation. Thus, the carbons which cost at that time about six cents apiece now cost about two cents apiece. The enclosed arc lamp has of recent years become popular, owing to its diffused light and a carbon life of from 100 to 150 hours.

It has been estimated that about $600,000,000 has been invested up to the present time in electric-lighting stations and plants in the United States.

The best storage cells tested at the Philadelphia Exhibition of 1884 gave a yield, under laboratory conditions, of 3.425 watt-hours per pound of electrodes (7.55 watt-hours per kilo) with an energy efficiency of 69.45 per cent., when discharged at the mean current density of 12.42 amperes per square foot of negative plate surface (1.34 amperes per square decimeter), while the deterioration was comparatively rapid. At the present time storage cells are in use giving, under laboratory conditions, a yield of from five to six watt-hours per pound of charged cell (11 to 13.23 watt-hours per kilo), with an energy efficiency of about 85 per cent., when discharged at a current density of 4.8 amperes per square foot of negative plate surface (0.52 ampere per square decimeter). There are now storage batteries installed in the United States to the aggregate capacity of about 56,000 kilowatt-hours. The largest installation has 166 cells, weighs 500 short tons and has an eight-hour discharge capacity of 22,400 ampere-hours, or 3,136 kilowatt-hours at 140 volts pressure.

A very great development has taken place in the direction of electric traction, by virtue of which the horse-car, once so well nigh ubiquitous in city streets, has almost entirely disappeared, while electric locomotives of 1,500 horse power have even made their appearance on steam-railroad tracks. The introduction of soft cast-steel has been very advantageous to the electric motor, enabling its output to be increased from five watts per pound of net weight in 1884 (11 watts per kilo), to about 14 watts per pound (30.9 watts per kilo) in street motors at the present time. It is estimated that there are to-day in the United States about 14,000 miles of electric railroad, with a nominal capital of about one billion dollars and employing about 170,000 men.

The electric transmission of the power of falling water is a branch of engineering that has come into service since 1884, and is making rapid strides, owing to the recent successful employment of high voltages and multiphase alternating currents. It has been estimated that about 150,000 kilowatts of this class of machinery is installed in the North American continent, commercially transmitting power to various distances up to 85 miles, at various pressures up to 30,000 volts.

The alternating-current induction motor has become very popular in recent years, mainly owing to its powerful starting torque and its freedom from commutator and brushes. A burned-out armature, the perpetual source of dread in motor operations of days gone by, is practically unknown in this type of machine, even when put to severe service. Indeed its depreciation under fair conditions appears to be as low as in any class of rotating machinery.

The alternating-current transformer has been correspondingly improved, developing, in large sizes, an efficiency of about 98.5 per cent. and an output, when cooled by external power, of about 100 watts per pound of weight (220 watts per kilo).

The principal engineering value of electricity to-day lies in its adaptation to the transmission of power, through mills or cities, or from some locality where power is cheap to another where it is dear. A steel rope, by its bodily motion, can transmit, with appreciable friction and depreciation, some hundreds of kilowatts to a distance of some thousands of feet. A bare, quiescent copper rope, half an inch in diameter, and supported on poles, can, by maintaining an effective potential of 10,000 volts, by the motion of electric waves over its surface, transmit, say, 2,500 kilowatts, with an energy loss of two-thirds per cent. per mile (0.4 per cent. per kilometer), and with practically no depreciation except to the poles and supports.

The use of high pressures has thus become more frequent during the last few years. Alternating-current generators are now made to supply 10,000 volts at their terminals, and insulation-testing sets

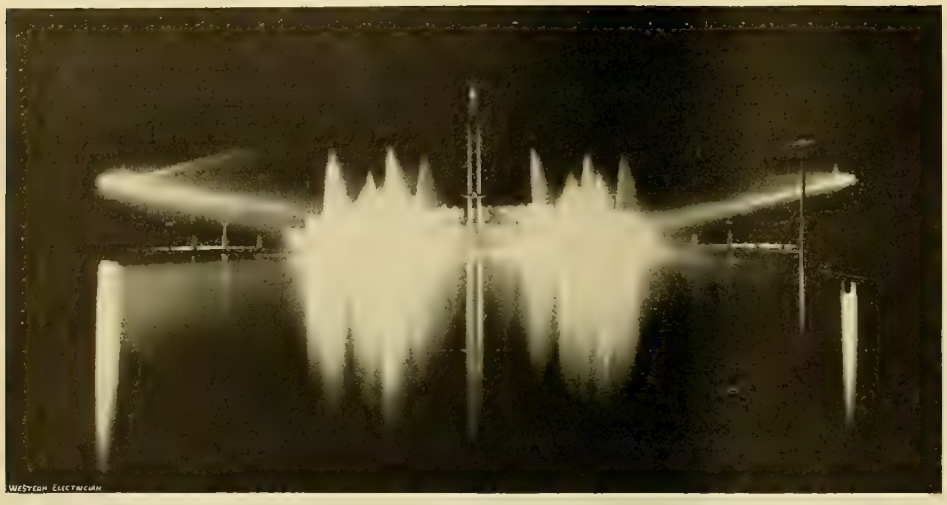
ILLUMINATION OF THE TRANS-MISSISSIPPI EXPOSITION.—EAST HALF OF GRAND COURT, FROM ISLAND.

1. Inaugural address delivered at the general meeting of the American Institute of Electrical Engineers, at Omaha, Neb., June 27, 1898.

have been made for producing alternating pressures up to 100,000 volts effective.

The application of electric power to domestic use and household comforts, irrespective of illumination, has made steady progress. In the large cities the fan-motor day load of summer is, in the aggregate, a perceptible quantity, while electric ranges and heaters, on a small scale, have found favor through their convenience.

In telegraphy comparatively little change has recently taken place, beyond the substitution of the



ILLUMINATION OF THE TRANS-MISSISSIPPI EXPOSITION.—FOUNTAIN UNDER BEAMS FROM PROJECTORS

dynamo or dynamotor for the voltaic battery, and of copper line wire with some five ohms per mile for iron wire with some 13 ohms per mile. About 1,000,000 miles of telegraph wire are now strung on some 200,000 miles of pole line in the United States, connecting about 25,000 offices, and working an invested capital of about $150,000,000.

In the United States the uniformity of the closed-circuit Morse system simplex, duplex or quadruplex is only varied by an occasional Wheatstone set. This crystallization of methods is not due to any lack of invention or capability of improvement in signaling speed, but rather to the apparently settled belief that the present systems are the most economical under existing conditions of traffic. In long submarine telegraphy the pressure of increasing traffic has made itself more distinctly felt, and automatic curb-senders have, to some extent, been introduced; but the physical difficulties in the way of attaining high speeds have, as yet, been obviated only in part by an increased expenditure in copper and gutta-percha, to obtain a diminished conductor resistance per mile. Wireless telegraphy has entered its experimental stage, and bids fair to enter practical service in the future, at least within a limited range. Its public use, thus far, in the United States seems to have been limited to blowing up at stated intervals, in the recent New York exhibition, miniature models of the Maine, at a distance of some 25 meters from the oscillator.

In telephony the most notable improvement in recent years has been the general substitution of metallic circuits for ground-return circuits, with great advantage to the convenience and effectiveness of the traffic. At the present time conversation is carried on commercially up to a distance of 1,800 miles, and quite frequently at distances of 1,500 miles. There are at the present time in the United States about 1,000,000 telephones connected with the telephone service of the country, employing a capitalization of about $100,000,000, 400,000 stations and about 900,000 miles of wire. Every day about 17,000 employes make, on the average, more than three millions of connections. About 300,000 miles, or nearly one-third of the total length of telephone wires, has, within the last few years, been made up into aerial and subterranean cables within city limits, owing to the reduction of the electrostatic capacity effected in such cable wires to less than one-twelfth of a microfarad per mile.

At no time has a useful discovery or improvement had more chance of welcome or application than at present. As an example the case of Röntgen rays may be cited. Professor Röntgen's celebrated paper announcing the discovery of X-rays was read in Wurzberg in December, 1895, and the particulars were not known in the United States until early in 1896. In the same year (December, 1896) radiographs were accepted as legal evidence in a United States District Court.

A considerable development has occurred in electrothermic and electrolytic proceses. More than 4,000 kilowatts of Niagara power are now employed in such processes. Among electrochemical processes are the electrolytic refining of copper to the extent of about 150,000 tons annually, the production of aluminum, the production of sodium and alkalies and the treatment of ores. Among electrothermic processes are the production of the carbides of silicon and calcium in steadily increasing quantities.

In electrotechnical theory considerable advance has been made of recent years, particularly in the study of alternating current. Accompanying the expansion of knowledge in the various branches there is a tendency to combine and unite into one general theory. Thus, while the dynamos originated as a source of low-tension electricity, which was once regarded as something so dissimilar to high-tension electricity as to require separate treatment and classification, to-day the high tensions derived from alternators through step-up transformers so far invade the territory of so-called frictional electricity that a dividing line between the two classes can no longer be maintained. Similarly, telephony and telegraphy are coming to be regarded as sub-classes of alternating-current power transmission, while electricity and magnetism cannot properly be studied apart.

Although a large amount of electrical work is done in physical laboratories in the United States, a comparatively small amount of the results of this work becomes available to the science or art of electrical engineering. Each year sees more than a hundred students engaged in experimental thesis work after a laborious training and preparation for several years in the technical college. Many of these men have the time and facilities to do the best experimental work of their lives under the guidance of their instructors. Some of the men display aptitude and interest in some special line of research in which they would be best left untrammeled, but in most cases the experimental work under co-operative guidance could accomplish a great deal for the knowledge and progress of our branch of applied science. There are numerous questions concerning the various electromagnetic properties of matter and of the ether that are of great and growing importance, and there are numerous scientific subjects of immediate practical importance that it is necessary to measure and observe, so that by uniting the available experimental resources of the various colleges in this country under a common leadership, in sympathy with the college instructors, the results which now largely fill thesis books lying on neglected shelves might be incorporated into permanent results for the general advancement of our profession. The plan would involve practically no expenditure beyond the voluntary efforts of those upon whom the duty devolved of formulating and dividing the subjects of research, and classifying or comparing the results attained. Such a system of co-operation among the students, through their instructors, would economize a large amount of the most skilled technical labor, and accelerate progress in all branches of inquiry, application and industry. No better work could be undertaken by our Institute than the fostering of such an organization.

The technical progress of a profession like ours is shown by the precision of which it is capable. A loose nomenclature begets looseness of observation and description and is inconsistent with a high degree of development in a science that quickens the footsteps of every human industry. The tendency of our machinery and definitions to become standardized is apparent in the impulse which has led the American Institute of Electrical Engineers to appoint a committee on standardization, the preliminary report of which is to-day laid before this Institute for consideration.

In connection with standardization it is important to observe that there has been of recent years a tendency to depart from the regular standards of dynamo machinery built by the manufacturers, in favor of special machinery of independent design. To a limited extent this is, of course, necessary, under the pressure of changing methods and conditions, but there is reason to believe that much more special machinery is built than necessity can warrant. Not only is the special machinery thus ordered or specified considerably more costly than standard machinery, but the tendency, by interfering with the natural shop methods of standardizing and cheapening production, prevents regular consumers from purchasing standard machinery at as low rates as would otherwise be possible. When we consider that the industrial radius of application of electricity mainly depends upon the first cost of the apparatus it employs, it needs no homily to drive home the conviction that the unnecessary introduction of special machinery is a puncture in the tire of progress.

Our Institute may well take pride in the share which it has taken in the electric progress of the 14 years which have elapsed since its inception. It now numbers 1,100 members. Its purpose is to aid all who seek to acquaint themselves with this branch of science and art, and to set the stepping stones of progress in the sands of time for the advance of the industrial applications of electricity.

ILLUMINATION OF THE TRANS-MISSISSIPPI EXPOSITION.—CONSTRUCTION OF FOUNTAIN.

Hertzian Waves for Alarm Service.

Clyde Coleman, a Chicago inventor, has secured a patent on a unique burglar-alarm device. He utilizes the Hertzian waves. The vault or other inclosure to be protected is equipped with a Hertzian-wave transmitter. This is suitably connected with an alarm system, so that it is thrown into action, when the mechanism is properly adjusted, by an attempt to enter the vault. At the police station or any suitable place is placed the receiving apparatus. It comprises a mass of particles adapted to be cohered by the Hertzian waves and to operate a signal device until the cohering particles have been decohered. The details of the system are worked out, and the apparatus is interesting as a practical application of a scientific principle of recent discovery.

American Institute of Electrical Engineers.

[Special Correspondence of the Western Electrician.]

Omaha, July 1.—The fifteenth general meeting of the American Institute of Electrical Engineers closed yesterday afternoon and the members who were in attendance have dispersed, some of them going to Lincoln with Professor Owens to visit the State University and the others returning to their homes. The meeting was a thoroughly enjoyable affair, and the proceedings will form an interesting and valuable addition to the records of the association.

Dr. Kennelly's inaugural address was an interesting review of the progress that has been made during recent years in electrical engineering. The data presented were secured only after much examination and investigation and represent much labor and thought.

The report of the committee on standardization of apparatus will attract much attention and discussion. It has been suggested that the movement is in the interest of the larger manufacturing companies, but it seems that the best answer that can be given to such an assertion is that the demand for some such system is not confined to any particular company or class, and the most earnest advocates of this measure are the small central-station managers who know from experience the value of standard apparatus. There can be no doubt, however, that unless the measure receives the attention which its importance demands from all classes of manufacturers and users that there is a possibility of the project being diverted from its original intention and turned to the advantage of some particular manufacturer. Such a contingency could only arise, however, through the neglect of others who are equally interested in the result, but who may not be as active and far-seeing in the present emergency. It would seem that this reason alone would demand that the broadest discussion be given the committee's report and the widest possible publicity afforded in order that every condition and contingency might be carefully considered before final action is taken. It will have much greater weight and be accepted much more readily if it is generally discussed before it is finally adopted by the Institute, and it will doubtless receive the stamp of approval much more quickly from other organizations too.

The papers which were read and discussed were of a high standard and will compare favorably with those considered at former gatherings. They were of a much more practical character than those that are usually read at the general meetings.

Several important subjects were acted upon, not the least of which was the determination to continue the work of the committee upon standardization upon practically the same lines that had been followed previous to making the report. It was also determined to follow up the suggestion of President Kennelly and secure the adoption of some method of classification and compilation of data gathered by students in the electrical engineering schools of the country and publish it in the Institute Transactions. A committee composed of Professor Owens, Dr. Kennelly, Professor Goldsborough, Dr. Eddy and B. J. Arnold was appointed to consider this subject. Its report was presented by Professor Owens at the closing meeting. The committee favored the suggestion and expressed the belief that such action would greatly stimulate scientific investigation and secure a much higher grade of work among the pupils. The time at the disposal of the committee, however, did not permit it to give the details any attention and it was accordingly suggested that the whole subject be referred to the council, with instructions to formulate a plan for the guidance of the educational institutions. There were several prominent representatives of technical education present, and all were highly pleased with the plan submitted. They believed that it would greatly assist them in securing careful and constant work from ambitious students.

The arrangements for the meeting included ample provision for the comfort and convenience of the visitors and their entertainment. Several novel features were introduced, including the initiation into the Knights of Ak-Sar-Ben, a trolley ride to Council Bluffs and view of the exposition grounds and buildings from an elevated point in Fairmount Park after dark, and the entertainment of the party with light refreshments served in the car before the return trip. Several visits to the Fair were arranged, and a trip through the Midway was also greatly enjoyed. The members of the local committee were attentive and diligent in making the occasion thoroughly enjoyable.

Professor Owens, to whom credit for bringing the meeting to Omaha this year is due, should feel gratified. The visitors not only enjoyed themselves, but they were instructed by their pilgrimage to the exposition. Moreover they fully appreciate the work that he performed and the influence he exerted in placing the facilities for their instruction and entertainment at their disposal. Professor Owens and his associates received the personal thanks of the members and their friends for the courtesies extended during the meeting, and a formal vote of thanks to Professor Owens was passed by the Institute upon motion of C. P. Steinmetz.

The following resolutions, reported by a committee composed of Messrs. Scott and Armstrong and Professor Shepardson were unanimously adopted:

The American Institute of Electrical Engineers, at its first general meeting west of the Mississippi, has been received with cordial hospitality, and every endeavor has been made to contribute to the convenience and pleasure of its members.

Therefore the Institute formally expresses its hearty appreciation of the many favors and courtesies which have been extended by its generous hosts in exhibiting the remarkable industries of Omaha, in presenting the beautiful "White City" which represents the progress and enterprise of the Trans-Mississippi West, and in many ways doing honor and contributing to the welfare of the members of the Institute.

In especial measure thanks are due to the city of Omaha, through its acting mayor, Mr. Bingham; to Mr. Rosewater, for courtesies extended; to President Wattles, in behalf of the Exposition; also to F. P. Kirkendall of the Department of Buildings and Grounds, for special attentions; to the Omaha and Grant Smelting and Refining company, the Union Pacific Railway company and Master Mechanic Manning, the Omaha Street Railway company, the Omaha and Council Bluffs Street Railway and Bridge company, Swift & Co. and Armour & Co. of South Omaha, the Knights of Ak-Sar-Ben, and the members of the untiring local committee.

During the afternoon Colonel Dickey and Mr. Umsted of the Western Union Telegraph company entertained the visitors at the headquarters of the company, and explained the workings of the improved apparatus which the company has just introduced.

W. F. White conducted the members to the plant of the New Omaha Thomson-Houston Electric Light company, which he is now remodeling.

This concluded one of the most successful and enjoyable meetings in the history of the American Institute of Electrical Engineers. J. B. O'H.

ILLUMINATION OF THE TRANS-MISSISSIPPI EXPOSITION.—BIRDSEYE VIEW OF GRAND COURT.

An electrical storm in Fond du Lac, Wis., burned out 60 telephones.

Alexander Kempt.

Alexander Kempt, whose death was reported in the Western Electrician last week, was buried in Eau Claire, Wis., his old home, on Friday, July 1st. Mr. Kempt had been in poor health for several years, and for the last three months had been confined to the house nearly all the time. He took to his bed about two weeks ago, and death came on Tuesday, June 28th.

A Scotchman by birth, Mr. Kempt first saw the light in Aberdeen on August 7, 1837. His boyhood was spent in England and Scotland, but he early evinced a determination to seek his fortune on foreign shores, and at the age of 19 he came to Canada and engaged in railroad work. This was at about the time of the panic of '57, and business was dull in the Dominion, so the young man shortly afterward pressed on to the United States, settling in Eau Claire, Wis., where he lived for 20 years. The young Briton was bright, industrious and had a way of making friends. He engaged in the lumber business and prospered. He was connected with two or three lumber concerns during his residence in Eau Claire, and for a number of years was secretary of the Eau Claire Lumber company. In 1867, at the age of 30, Mr. Kempt was married to Miss Josephine Brunelle of Menomonie, Wis., a lady of refinement and culture, who was ever a faithful and devoted wife. She survives her husband with a son and a daughter—Walter and Josephine.

In the year 1879 Mr. Kempt decided to engage in the iron-mining business, and removed to Florence, Wis., for that purpose. At this period of his life he was severely injured in a railroad accident on the Northwestern road, and so badly hurt that he had to give up all business for a year.

ALEXANDER KEMPT.

Mr. Kempt never fully regained the robust health of previous years, and it is believed that this accident was the indirect cause of his death. In 1883 he came to Chicago, with his family, and engaged in electrical pursuits. His ability was recognized, and the next year he was placed in charge of the western business of the Brush Electric company, with an office in Chicago. This was at the time of the great expansion of the electric-lighting business, and from the prominence of the Brush company in the arc-lighting field Mr. Kempt's position was an important one. He received a large salary and ranked with the leading electrical men of Chicago. He was one of the early members of the Chicago Electric Club and served as vice-president of that organization. His circle of acquaintances was large and his friendship was prized. On January 1, 1893, Mr. Kempt resigned from the Brush company and went abroad for the greater part of a year. He returned to Chicago, but he was far from being a well man, and of late he had not actively engaged in business.

A Point Well Taken.

[From the Electrical Review.]

Our New York contemporary, Electrical Earth, was taken to task last week by the Western Electrician for publishing a reflection on Chicago as a conveniton city for the National Electric Light association. We think the point well taken. New York and Chicago are the two cities that will naturally attract the largest attendance, and we believe that the association acted wisely in selecting them for alternate conventions hereafter.

The Central Traction company will probably increase its capital to $5,000,000 in order to build a number of additional electric lines in St. Louis.

The Valdosta (Ga.) Street Railway company, which proposes building a line in that city, has applied for a charter. It is to have a capital of $50,000. Among those interested are T. G. Crawford and Frank Roberts.

Western Electrician.

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CIRCULATION, 20,000.

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With the introduction of the electric railway in Great Britain complaint is made of the electrolytic corrosion of gas, sewer and water mains. A report has been submitted to the gas and water departments of Glasgow on prevention of electrolysis of the gas and water mains along the Springburn electric tramway route. The electrical resistance of the steel rails was about ten times that of copper. The greatest fall of potential between one terminus and the power station was estimated at 5.56 volts. This is well within the Board of Trade limit of seven volts, and the railway department does not, therefore, intend to put in return feeders, as the expert thinks that, with good bonding of the rails, there will be no fear whatever of electrolysis of gas or water mains. If the nature of the soil is favorable very little harm may be done for many years, but if the conditions are unfavorable the gas and water pipes may be rapidly corroded at joints, or at the place of exit of the current. The use of insulated return feeders with supplementary electromotive force is urged, as this plan would obviate all risk.

An English contemporary gravely announces that "the queen has been pleased to accept a copy of the recent work on 'Submarine Telegraphs,' by Charles Bright, F. R. S. E., and of the brochure entitled 'Science and Engineering During the Victorian Era,' by the same author." Of course she did. The books may come in handy when some of the children of the royal household take up the study of electrical engineering.

The action of the telegraph companies in inviting the public to come forward and bear the whole burden of the war tax on telegraph messages is sharply criticized. The Western Union company, in particular, has made immense profits out of the business. Undoubtedly it could well afford to buy the stamps and affix them to the copies of messages filed, or it could pay the tax by making a sworn statement of its business or by some other arrangement satisfactory to the government. By such action as this the companies could win public approval, rather than strengthen the hands of those who contend for government control of the telegraphs, as they are doing. The companies interpret the law to their own benefit, as shown by the Postal company's bulletin of information, reprinted on another page, but the courts will undoubtedly be called upon to decide whether their assumption is a legally correct one.

In marked contrast to the action of the telegraph companies is the position of the telephone companies, which have thus far made no additional charge to the public for toll-line messages, defraying the tax themselves. The telephone companies accept 15 cents as the least charge for a message and out of it give the government one cent tax; the telegraph companies have a minimum rate of 25 cents, and the customer must pay one cent for a stamp in addition. If the telephone companies can bear the tax, why not the telegraph companies?

Every friend of the independent telephone movement in the country will sincerely hope that the sweeping changes in the constitution of the Independent Telephone association which were made at the Chicago convention last week will advance the organization to the position it should occupy in the confidence and esteem of the thousands of men in the United States who are interested in anti-monopoly telephone enterprises. That the association has not occupied such a position is shown, we think, by the convention itself. The attendance was so small that dissension and dissatisfaction can give the only explanation. The weather was warm, but that fact would not deter earnest men; the independent telephone industry itself is advancing by leaps and bounds, so that the exchange operators present should have been numbered by hundreds where there were tens; the convention was held in the West, which is the section that has witnessed the greatest expansion of the new industry. The simple fact was that the meeting was slimly attended because the good-will of telephone men inside and outside of the association had been alienated, and the interest had languished in consequence.

It is not necessary to enumerate in detail the causes of this unfortunate state of affairs. They are sufficiently indicated by the remedial changes that were made in the constitution. But there is one reform that still remains to be carried out, and that is in the direction of open sessions. The association has the sympathy of the people, and it should have little to hide from them. It is conceivable that in discussing possible defenses to litigation, for instance, it would not be wise to post the opposition as to plans and methods; but, in general, a free and open interchange of ideas would be healthy and beneficial. The reading and discussion of papers on telephone construction and operation, on methods of charging, toll-line co-operation and the like should be a great help to hundreds of men who have but recently engaged in the telephone business and could not fail to greatly strengthen the association. Nothing of the sort has been attempted, but we trust that, with a remodeled constitution, the association will enter upon a career of real usefulness, with the idea of mutual helpfulness as its basic principle.

American engineers recognize the advantages to be gained by the standardization of machinery, first of all in economical production, and secondly in providing for the convenient duplication of parts. The importance of this subject has been recognized by the American Institute of Electrical Engineers and the National Electric Light association, and both of these organizations are now considering the problems involved.

English engineers are likewise interested in the subject, and there seems to be a possibility of the adoption of some scheme of this kind. The English technical press recognizes that English manufacturer are gradually being supplanted by American productions, and this knowledge is spurring them on to united effort. The London Electrician admits that a thorough system of standardization brings about a temporary commercial benefit in the industry into which it is introduced, as it not only cheapens and accelerates manufacture and popularizes the products, but it improves the load-factor. Our contemporary makes the reservation, however, that in a progressive industry, such as the electrical trade, "the more completely standardization is carried beyond a certain point, the more progress is liable to be impeded." This, of course, is a very indefinite qualification and it may be accepted as a virtual admission of the correctness of the position of those who favor the standardization of apparatus of this description. Moreover, our contemporary adds: "We agree that too much variety exists in the equipment of smaller stations, and that if these were built as much on similar lines as the local circumstances of each case would allow, it would be a gain to everybody concerned, except, perhaps, to the consulting and resident engineers." Again, however, the habitual reservation is made, this time in the following terms: "But in the case of more important schemes, anything more than very limited standardization is not desirable."

American practice has proved conclusively that the nearer we approach absolute standardization in general work the better it will be for the manufacturer, the purchaser and the engineeer. High-class engineers have long recognized the desirability of adopting a system of standardization. Of course there are special cases where special conditions require special apparatus and special construction, but these are comparatively few in the great aggregation of enterprises considered. Our contemporary quotes Dr. Hopkinson approvingly when he says: "The engineer who can only do that which he has seen done before may be a practical man, but he will always belong to a lower grade of the profession." The great trouble with men of limited experience is their desire to show their capacity for invention and originality in design. An intimate knowledge of the requirements of service and familiarity with existing apparatus would prevent them from attempting to develop an independent system when standard apparatus would serve the same purpose. There have been some lamentable failures due entirely to this weakness on the part of engineers to introduce what they are pleased to term individuality into their work. English capitalists are beginning to see the fallacy of the claims of their countrymen who contend that each plant requires special machinery and should be designed and built on distinct lines of its own.

The best American practice to-day, supported by extensive experience, favors the adoption of standard apparatus excepting in special cases where there are particular reasons for designing special machinery. So strong is the tendency in this direction that the question of adopting universal standards for the country is now receiving favorable consideration.

DEVELOPMENT OF THE TELEPHONE FIELD.

TELEPHONE CONVENTION.

Important Changes in the Constitution of the Independent Association.

The attendance at the second annual convention of the Independent Telephone Association of the United States at the Palmer House, Chicago, last week was not large, but very important business was transacted. A meeting of the executive committee was held on Thursday afternoon and there were private sessions of the association on Friday and Saturday. President Thomas was in the chair. Changes were made in the constitution, by which the scope of the association was broadened to take in the manufacturers and supply men. The salaries of the officers were cut down one-half, the power of assessment was very materially modified, the offices of secretary and treasurer were consolidated, and the attorney of the association, H. D. Critchfield of Mt. Vernon, O., returned one-half of the fees that had been voted him. These radical reforms meet much of the criticism to which the management of the association has been subjected, and it is hoped that the organization will now move forward to the place which it should occupy.

The changes in the constitution were made on the recommendation of a committee consisting of H. D. Critchfield of Ohio, S. P. Sheerin of Indiana and H. K. Cole of Kentucky.

The articles of the constitution relating to "Name" and "Objects" are unchanged. The third article, "Membership," is greatly modified. The first section, providing for a general membership fee of $10, remains as before, but the second section now reads:

Sec. 2. The payment from time to time of such further assessments as the association through its proper committee may levy, not to exceed in any one year 10 cents for each telephone in use by any exchange or toll-line company and 10 cents per mile of toll lines carrying a wire or wires over which paid messages are transmitted.

In the original second section of this article this assessment was 50 cents instead of 10 cents The old third section, providing for the "voluntary contributions" and honorary memberships of the manufacturers is done away with, and the manufacturers and supply men are admitted on the following terms:

Sec. 3. Any corporation, partnership or individual engaged in the manufacture of telephones and switchboards, or either, may become a member of this association upon payment of a membership fee of $10 and annual dues in the sum of $100. The membership fee to be paid but once, and the annual dues for the first year to accompany said membership fee, and be paid annually thereafter upon notification by the secretary of the association.

Any corporation, partnership or individual engaged in the sale of apparatus or materials used in the construction, operation or maintenance of an independent telephone exchange, toll line or system, except such corporation, partnership or individual as may be engaged in the manufacture and sale of switchboards and telephones, or either, may become a member of this association upon payment of a membership fee of $10 and annual dues in the sum of $50, to be paid in like manner and time as hereinbefore provided for the payment of the same by manufacturers of telephones and switchboards.

Article IV., "Officers," now reads as follows:

The officers of this association shall be a president, three vice-presidents, a secretary and treasurer in one person, two assistant secretaries, and an advisory board consisting of five members, two of whom shall be the president and secretary of this association, together with three others who shall be selected by the executive committee. The president and secretary of the association shall be ex-officio chairman and secretary of the advisory board and executive committee; provided, however, that no person financially interested in the manufacture or sale of telephones or supplies or materials used in the construction, operation or maintenance of a telephone-exchange or toll lines shall be eligible as an officer or member of the executive committee of said association.

By this action the offices of secretary and treasurer are consolidated, the advisory board is cut down from nine to five members, and the qualifications for office are stated.

Article V., "Committees," was amended so that the executive committee is to consist of but one member from each state, instead of two.

The article relating to the election of officers is changed to prohibit voting by proxy; only members present in person can vote on any question.

Section 1 of article VII., relating to "Duties of Officers," was amended by striking out the words and figures "$2,500 per year," and inserting the words and figures "$1,200 per year," thereby reducing the salary of the president of the association from $2,500 to $1,200 a year.

The section of this article relating to the treasurer is stricken out, as one person is now both secretary and treasurer. The duties of this officer are defined. His salary is limited to $400, instead of $1,000, as originally provided. He has an allowance for actual expenses, like the president, and is similarly required to give a bond to be approved by the advisory board.

Article VIII., on "Representation," is amended to give each person, firm or corporation admitted to membership under section 3 of article III. (as above) one vote. Other members are entitled "to one vote for each 500 telephones or less, or for each 500 miles of toll lines or less, in actual use, and one additional vote for a major fraction of 500 telephones or miles of toll line in actual use, and no more."

Under the amended constitution these officers were elected and appointed:

President, James M. Thomas, Chillicothe, Ohio; first vice-president, H. C. Young, Columbia, Pa.; second vice-president, S. T. Slade, Oskaloosa, Iowa; third vice-president, J. B. Weare, Grand Rapids, Mich.; secretary and treasurer, W. J. Vesey, Fort Wayne, Ind.; first assistant secretary, George W. Beers, Fort Wayne, Ind.; second assistant secretary, D. C. Dow, Cobleskill, N. Y.; advisory board: James M. Thomas, Chillicothe, Ohio; W. J. Vesey, Fort Wayne, Ind.; H. B. Critchfield, Mt. Vernon, Ohio; Hugh Dougherty, Bluffton, Ind.; E. B. Fisher, Grand Rapids, Mich.; executive committee: I. A. Lumpkin, Mattoon, Ill.; S. P. Sheerin, Indianapolis, Ind.; C. F. Bennett, Watertown, Iowa; T. A. Pedley, Owensboro, Ky.; E. B. Fisher, Grand Rapids, Mich.; H. D. Critchfield, Mt. Vernon, Ohio; H. C. Young, Columbia, Pa.; F. F. Sapt, Nashville, Tenn.; D. A. Mossman, Huntington, W. Va.

After the election of officers the following resolution was adopted:

Whereas, The express companies have in many cities all over the country, presumably at the instigation of the Bell Telephone monopoly, issued orders directing the taking from their several offices such telephones as are not furnished free of charge.

And Whereas, We regard this act as a direct assault upon the independent telephone interests of the whole country,

Therefore, be it Resolved, That the Independent Telephone Association of the United States in annual convention assembled, believing that just compensation for service and a right to enter into a fair competition in every line of business are the inalienable rights of American citizens, do denounce this action of the express companies as an outrage upon the common rights of citizenship, which we advise and urge all the local independent companies to resent each in its own way, appealing to their patrons and fellow citizens to aid them in their efforts by sending as many of their light shipments by mail or fast freight as possible, and we especially recommend that all independent telephone companies order all their own exchange and line supplies shipped in like manner.

After transacting miscellaneous business and a general discussion, the association adjourned to meet in June, 1899, at a time and place to be hereafter fixed by the executive committee, unless sooner called in convention by the president.

Under the revised constitution several new members were admitted. The list of new members follows: New Telephone company, Indianapolis; Southern Telephone company, Nashville; Electric Appliance company, Chicago; Julius Andrae & Son company, Milwaukee; Western Telephone Construction company, Chicago; Ericsson Telephone company, New York; Victor Telephone Manufacturing company, Chicago; American Electric Telephone company, Chicago; Marysville Telephone company, Marysville, Ohio; Sterling Electric company, Chicago; Stromberg-Carlson Telephone Manufacturing company, Chicago.

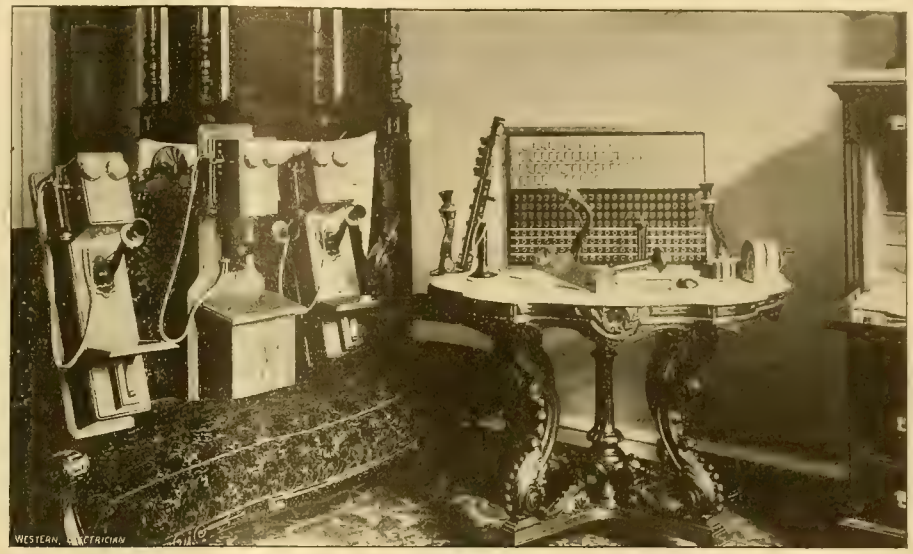


EXHIBIT OF VICTOR TELEPHONE MANUFACTURING COMPANY AT THE TELEPHONE CONVENTION.

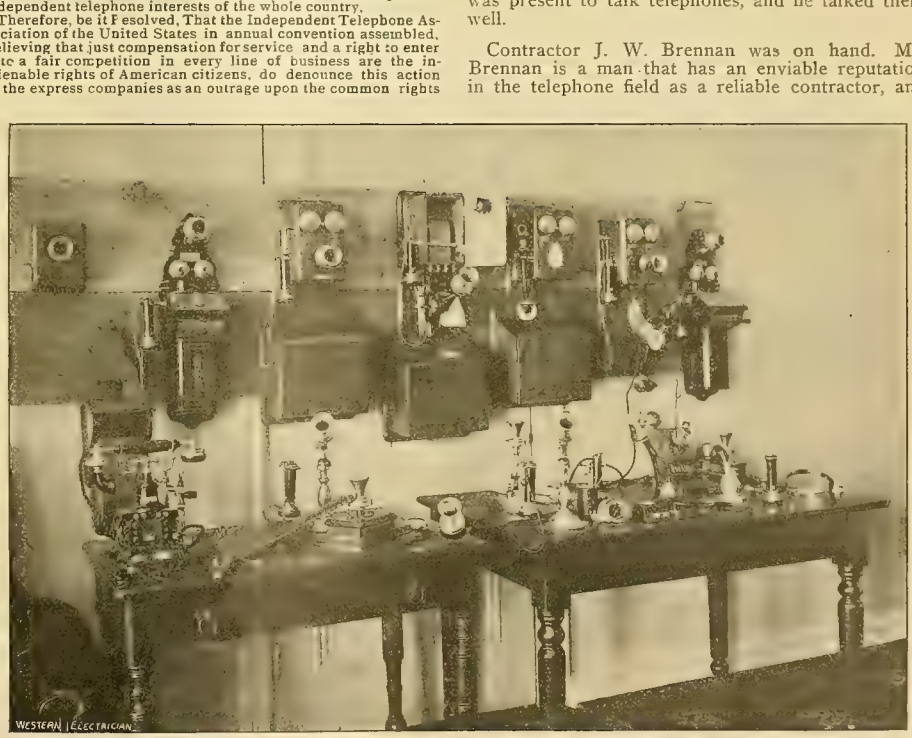


EXHIBIT OF ERICSSON TELEPHONE COMPANY AT THE TELEPHONE CONVENTION.

Notes and Gossip.

The National Carbon company's representative was of course on hand.

Representative Charles H. Sewall of the J. A. Roebling's Sons company mingled with the boys.

General Agent William Hubbard of Elgin, Ill., was present to talk telephones, and he talked them well.

Contractor J. W. Brennan was on hand. Mr. Brennan is a man that has an enviable reputation in the telephone field as a reliable contractor, and it is said that he has been most successful in this business.

Manager J. D. Leatherbee of the National Telephone Manufacturing company came from Boston to be on hand at the convention.

Where was Hull of the Cabinet Manufacturing company? He had promised his friends that he would be on hand, but did not put in an appearance.

George Whyte of the Leschen-Macomber-Whyte company was in attendance. Mr. Whyte is one of

those gentlemen to whom people usually refer at conventions as being "all right."

Frank Donohoe and his lieutenant, E. H. Hammond, of the American Electrical Works were right there. Messrs. Donohoe and Hammond took this occasion to "play their cards" well.

It would have paid the Mason Telephone Pay Station company of Ludington, Mich., to have had one of its booths on exhibition at the telephone convention. These booths would no doubt have met with ready appreciation on the part of the modern telephone managers.

Of course President W. W. Low of the Electric Appliance company was in attendance, and this time he was accompanied by Mr. A. L. Millard. Mr. Low is an indefatigable attendant at conventions, and each time one wonders how it is possible that he increases his popularity.

The Farr Telephone and Construction Supply company entertained many of the visitors to the convention. As is well known, the Farr company is the only wholesale telephone supply house in the West, and the excellence of its goods has given the company a fine standing among the trade.

The Western Telephone Construction company was strongly represented by President J. E. Keelyn, General Manager H. C. Dodge and Charles P. Platt. This company made no exhibit, but it is needless to say that its representatives did the usual amount of fine work among the telephone people.

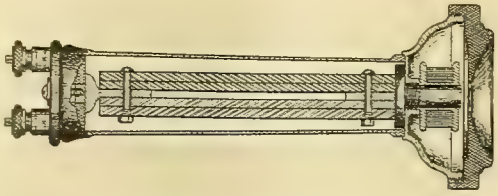
Naugle, Holcomb & Co. of Chicago were represented by Messrs. John H. Fowler and George Weston. The latter is the manager of the construction department. The firm is doing a very excellent business in poles, to say nothing of its extensive street-railway constructing business. It seized the opportunity of adding to its already large number of friends in the telephone field.

The hustling representative of the Julius Andrae & Sons company, James S. Healey, was there in fine feather, and his "always to the front" is doubtless ringing in the ears of many an independent telephone man. The company is doing a flourishing business in bicycles, and its telephone business has reached a point that makes it the envy of many concerns doing business throughout the Northwest.

President L. P. Smith of the Ericsson Telephone company and the Smith & Hemenway company, New York, accompanied by P. J. Hertz, was among the first to arrive on Thursday morning. These gentlemen made a most interesting exhibit of the Ericsson telephones, switchboards, telephone supplies, and also displayed a board of telephone-hardwood specialties. On page 21 a picture is shown which will give a clear idea of the fine class of instruments exhibited by Mr. Smith. The enterprise of the Ericsson company in coming from New York to take advantage of the present opportunity at the telephone convention was appreciated.

Of course the Sterling Electric company, now so well known as the company that furnishes Bell apparatus for independent telephone companies, was most decidedly in evidence. Both President W. E. Doolittle and Electrical Engineer Frank B. Cook were daily on hand, and their work will undoubtedly tell. The Sterling company called particular attention to a handsome section of a switchboard that was recently manufactured by the Sterling company for the Valley Telephone company of Saginaw, Mich. The Sterling company's factory in Chicago is one of the largest in the country, and those interested in purchasing high-class telephone apparatus, made by men long experienced in the business, should visit it.

The American Electric Telephone company was of course kept to the front in that inimitable manner so characteristic of its energetic president, P. C. Burns. Mr. Burns was accompanied by Mr. I. J. Kusel, and although they professed to make no exhibit, they had two of the American company's fine instruments placed to the left of the entrance of the convention hall where they could be seen by everyone. These two instruments were examples of the finest sort of telephone work. One, finished in ebony with silver trimmings, was particularly striking, and the second was just the opposite in style, pure white with gold finishings. The two instruments made a convincing exhibit illustrative of the high class of instruments manufactured by the company. It is needless to say that the "feat" which President Burns advertised would be performed for three days at his store excited no little interest, and his clever and generous effort, as evinced in this display of hospitality, was thoroughly appreciated by out-of-town telephone men. In the picture presented below the two highly ornamented telephones referred to above are seen at the right of the desk. These are the two equipments that were removed from the company's stock, as shown in the picture, for special display at the telephone convention.



HOLTZER-CABOT TELEPHONE RECEIVER.

The Stromberg-Carlson Telephone Manufacturing company was represented by Messrs. Stromberg and Shafer. These gentlemen were on hand daily, and were unfailing in their courtesies, not only to visiting telephone men, but to their competitors as well. The company has rapidly pushed itself to the foremost rank of telephone manufacturers, and to-day stands as one of the foremost among those which pay the strictest attention to details and turn out telephone apparatus constructed on the most scientific lines. One has only to place his ear to a Stromberg-Carlson telephone to appreciate the force of the claim made for it. A new thing presented by the Stromberg-Carlson company, or, to put it in the company's own language, the central-energy telephone ssystem, excited a great amount of interest. This system is said to be the only one of its kind on the market, and it is claimed to be the system of the future. One of the main features of the system is that the machinery is so placed that all the parts subject to deterioration and wear are placed at the central office, leaving nothing at the subscriber's station requiring attention.

On page 21 is presented a view of the exhibit made by the latest comer in the telephone world, the Victor Telephone Manufacturing company of Chicago. This concern has only recently opened its office and factory at 166-174 South Clinton street, Chicago. The business will be conducted by William T. Blaine, general manager, while the engineering department will be in charge of E. E. Yaxley, who is one of the most experienced and favorably known electrical engineers in the telephone business. The purpose of the company is to manufacture switchboards, cross-connection boards, lightning arresters, telephones for long distance, toll-line and exchange work, also for factory and private lines; in fact, it is proposed that the Victor company shall be in line to handle, construct and equip exchanges of any magnitude desired. The company's factory is equipped with the latest and most improved machinery and is in charge of a corps of able engineers. Mr. E. E. Yaxley, who is in charge of the factory, is a telephone man of long experience, and an inspection of the company's apparatus that was on exhibition at the convention and also at the factory gave a good indication of his talents as a telephone engineer. It is hardly necessary to say that the many excellent features in the company's apparatus can only be appreciated on careful inspection by men capable of appreciating scientically constructed telephone apparatus.

INSTRUMENTS OF THE AMERICAN ELECTRIC TELEPHONE COMPANY.

Holtzer-Cabot Telephone Receiver.

It is a fact patent to even the casual observer that one of the chief troubles in telephone service is due to poorly constructed and defective receivers. Not "how perfect" but "how cheap" a receiver can be turned out has been the policy of some manufacturers. However, the Holtzer-Cabot Electric company, well known for high-grade telephone apparatus, has just placed upon the market an improved metal-head receiver that is certainly not open to this objection.

The construction of this receiver is shown in the accompanying cut. The head or cup is of metal, which is firmly attached to the pole-piece which carries the permanent magnets; the rubber shell is merely held up against the shoulder of the head by a screw at the farther end. It will be seen that no variation of temperature nor rough handling can affect the adjustment between the tip and the diaphragm, which is accurately and permanently made in the factory; besides, in this receiver, rust is prevented from falling down and accumulating upon the magnet tip, a defect noticeable in some receivers.

The large sale the Holtzer-Cabot receivers are having and the favor with which the new metal-head one is meeting show that the independent companies are awakening to the benefits to be derived from using high-grade apparatus.

The company's new telephone catalogue No. 32, recently issued, gives full information regarding magneto bells and other lines of telephone apparatus. It may be had by those interested by dropping a line to the Holtzer-Cabot Electric company, Brookline, Mass.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The telephone war at Ottumwa, Ia., waxes warm, with each company advertising freely its own virtues and the other's vices.

The Lamoni Telephone company of Lamoni has extended its lines to Caledonia, 12 miles.

Several months ago the citizens of Massena and Cumberland, Ia., were quite anxious to secure telephone connection with Atlantic, and subscribed to the Iowa Telephone company to induce it to extend its lines to those places. After waiting a while the citizens took matters in their own hands and established a line of their own, which has been in operation for 60 days. Now the Iowa company announces that it will build the line and has set poles to Massena. When the company attempted to set poles in the city limits the council refused permission. As it now stands, the company has set poles for 24 miles and is only able to get into Cumberland, where it is reported that trouble will be made soon.

The Boone County Telephone company has completed the installation of its metallic circuit between Boone, Ia., and Des Moines.

The council of Ute, Ia., has granted a franchise to the Iowa Telephone company for a telephone exchange, subject to the approval of the voters.

The Humeston Telephone company is preparing to install an exchange in Humeston, Ia.

The Wausau Telephone company of Wausau, Wis., has added a new switchboard section. It is made by the American Electric Telephone company of Chicago, and is on trial.

The council of Fort Dodge, Ia., has granted a franchise to the Fort Dodge Telephone company. The city will vote on the franchise July 25th.

A telephone line is being constructed between Benson and Swift Falls, Minn. J. M. Danelz of Swift Falls is the projector.

The Central Telephone company proposes to build a line from Farnhamville, Ia., to Gowrie, and possibly to Fort Dodge.

The Richland Center Telephone company has been granted the right to set telephone poles into Reedsburg, Wis. The People's Telephone company has been admitted to the city, but must use the former's poles. Now the latter company is ready to string wires and the former will not set

poles. The council will probably look into the matter.

The Cedar Valley Telephone company is setting up a 600-drop switchboard at Waterlooo, Ia.

The new telephone exchange at Canton, S. D., is about ready for operation.

The Dakota Central Telephone company of Aberdeen, S. D., contemplates a line from Aberdeen to Pierre, via Huron and Brookings.

Castana, Ia., will vote July 12th on granting a franchise for a telephone system to the Iowa Telephone company.

The council of St. Paul has approved a route for the Mississippi Valley Telephone company to enter the city and to set poles.

The Northwestern Telephone Exchange company is preparing to erect a handsome modern sub-exchange building at Laurel avenue and Dale street, St. Paul. The building will be of brick and stone and will cost about $7,000. The company will erect a similar building at Twenty-sixth street and First avenue, South, Minneapolis, for a sub-exchange.

Telephones have been placed in farmhouses on a line between Fountain City, Wis., and Dodge, using the centrally located houses for use of all the residents of the vicinity. The farmers use them freely to get grain quotations before coming to the city, and in many other ways find them very useful.

Telephone Exchange at Lockport, Ill.

The telephone plant recently opened at Lockport, Ill., is in many respects worthy of special attention, as it includes many entirely new features. The outside construction is of substantial character, with a strictly metallic circuit throughout. Cable is used, as far as practicable, for bringing the leads into the exchange, thus doing away with a network of wires around the central office.

In the accompanying cuts Fig. 1 shows two 50-pair and two 25-pair cables leading into the front of the exchange building. The cables run out to the principal points for distribution, where they terminate in the Cook pole-top terminal. The cables are supported on a three-eighths-inch steel strand with the Hallett L. and S. cable hook. The poles are all straight cedars from 35 to 50 feet high, with seven-inch tops, and are guyed in a most substantial manner. The exchange is equipped with the central-energy telephone system made by the Stromberg-Carlson Telephone Manufacturing company of Chicago. Fig. 2 shows a subscriber's instrument at a residence station, equipped with the S.-C. long-distance transmitter and receiver, the same as the regular telephones, but it has no generator. The

FIG. 1. TELEPHONE EXCHANGE AT LOCKPORT, ILL.

central office is signaled by pressing a push-button which throws in a current supplied at Central.

Owing to many outside connections with exchanges employing the regular type of apparatus, the company contemplates putting in a local battery for talking, using one cell, which is sufficient for the instrument used. The equipment is so arranged, however, that at any time, by putting in repeaters at the line leading to other systems, all the talking battery can be placed at Central, doing away with all battery at subscribers' stations.

The exchange was opened in a most unique manner, a concert being given at the central office, to which all the subscribers were invited to listen over the wire. Fig. 3 shows the exchange operating room, the transmitter being provided for the occasion with a receiving cone.

While the announcements of the different parts of the programme could be understood only by those with a receiver to the ear, the music could be heard plainly by all near the instruments throughout the system.

Lockport can boast of having the first S.-C. central-energy telephone system built for public-exchange purposes, though the system has been in use more than a year in many large private plants.

Extension Telephones.

The Chicago Telephone company announces a reduction in rates for extension telephones to $30 per annum for places of business and $20 per annum for private residences. Extension telephones are portable desk instruments of the long-distance pattern, installed only in connection with metallic circuits. They are used to supplement the regular long-distance instruments, and, being portable, are calculated to save the time of the busy office man. From the circular of the Chicago Telephone company it is understood that they are not installed separately.

The Merry Jest in Grand Rapids.

The Grand Rapids Press relates this incident about a man and a woman who are employed in

FIG. 2. TELEPHONE EXCHANGE AT LOCKPORT, ILL.

different offices in one of the large buildings of that city. Each office has a telephone, but, as it happens, one is an instrument belonging to the Citizens' company, the other a Bell instrument. One day the man had occasion to use the Citizens' line and stepped across the hall to the lady's office. "Have you a Citizens' phone?" he asked, and she replied in the affirmative. "Well," he ventured, "I'm a citizen. May I use it?" Why, of course, he might use it. An hour later she balanced the account with him. "Have you a Bell telephone?" she asked, on stepping into his office. He did not try to deny it. "Well, I'm a belle. May I use it?"

Extensions and Improvements.

F. Smiley and Gus Knight, Jr., will erect a telephone line from Highlands, Cal., to Bear Valley, via Fredalba.

The Boone County Telephone company, Boone, Iowa, has placed an order with the Sterling Electric company of Chicago for one of the finest toll boards of its size that will be used in that state.

The arrangements for the construction of the new telephone line from Missoula to Wallace, Mont., are being perfected, and it is thought that the work will be begun at once. The people of Colona and Garnet are still hoping that they may be successful in getting a line built from Bearmouth to their camps.

A Fitting Acknowledgment.

The board of directors of the Omaha Exhibition has deemed it fitting to officially recognize the exceptional work of the exposition architects-in-chief, the landscape artist and the electrical experts, and it was done by resolution, introduced by General Manderson at the last meeting. The resolution read as follows:

The directors of the Trans-Mississippi and International exposition, in parting with the professional services of the architects-in-chief of the exposition, their great work being now accomplished, desire to express their unbounded satisfaction with the result and their unqualified approval of the methods that have been pursued. The world has not seen a more perfect aggregation of buildings than those that constitute the exposition proper, and the able architects who designed them are entitled to the enthusiastic praise that comes to them from all who view them. Much credit is due to all, and, with no desire to be invidious, the board desires particularly to commend the ability, skill and devotion of the architects-in-chief, Messrs. Walker & Kimball of Omaha. On behalf not only of the exposition, but of the trans-Mississippi country, we extend to them our congratulations and hearty thanks.

We recognize also the skill and ability of Mr. Rudolph Ulrich, landscape artist; of Mr. Luther Stieringer, consulting engineer, and of Mr. Henry B. Rustin, the superintendent of light and power, and thank these gentlemen for the magnificent result we have found in which they have been prime factors.

Resolved, That copies hereof be sent to the gentlemen named and be published in the press.

Mr. Manderson moved its adoption, Mr. Kirkendall seconding, and the motion was carried unanimously.

General Electric Company.

The directors of the General Electric company have voted to recommend to the stockholders a reduction in the share capital of the company, both common and preferred, of 40 per cent., so that each holder of 100 shares of present stock will get 60 shares of the new stock. This settlement, while satisfactory to the common stockholders, is regarded as particularly favorable to the preferred shareholders, inasmuch as it will render unnecessary the taking of any steps for the liquidation of the company, in which event the preferred stockholders would receive only the same amount as the common stockholders, and no back dividend. The plan now adopted contemplates the payment, from the surplus earnings of the company, as they are hereafter made, of the accrued dividends on the preferred stock. On the basis of the new capitalization $1,275,000 will be required annually to pay seven per cent. upon the preferred stock and six per cent. upon the common stock. The stockholders' meeting will be held at noon on August 10th in Schenectady.

Trade Opportunities in Russia.

There is perhaps among the foreign markets none more suitable for the introduction of electric plants than Russia. The importance of this valuable and vast field—with an area of more than 8,000,000 square miles, or over twice that of the United States—may be gathered from the following figures, which represent the value of "machinery" imported into Russia during the last five years:

1893	$14,242,110
1894	24,512,105
1895	27,810,210
1896	33,122,650
1897	37,110,530

Russia, in 1897, imported about three and a half times more machinery than Mexico, Central and South America together. We should, of course, by all means continue to cultivate the Spanish-American markets, but we should at the same time pay a little more attention to Russia and the possibilities for developing our trade with that country. Russia is exerting herself to the utmost in order to create a home industry capable of meeting the requirements of the Russian markets, but for the coming 10, 15 and more years the Northern Empire will doubtless continue to depend upon large importations from abroad. At present Germany and Great Britain are monopolizing this market. Our exports to Russia, although steadily increasing, are still relatively unimportant. Unfortunately, the United States official statistics give no special figures on the exports of electrical machinery, this being included in the item of "machinery not elsewhere specified," of which our exports to Russia during the last five years were as follows:

	1893	1894	1895.	1896	1897.
Russia, Baltic and White Sea	$44,963	$83,354	$151,512	$262,953	$736,218
Black Sea	13,756	12,498	58,968	170,750	337,910
Siberia	8,679	690	13,500	103,237	15,553

Very little of this, however, is electrical.

Another item of the United States statistics reads: "Instruments and apparatus for scientific purposes, including telegraph, telephone and other electric instruments," of which we sent to Russia:

	1896.	1897.
Baltic and White Sea	$1,406	$33,445
Black Sea	3,497	4,223

In 1896 the imports of "dynamos" into Russia amounted to a value of $672,180, and in 1897 they

FIG. 3. TELEPHONE EXCHANGE AT LOCKPORT, ILL.

rose to $1,141,610, almost entirely from Great Britain and Germany.

The following shows the imports of "electric-lighting apparatus" into Russia:

1894.	1895.	1896.	1897.
$241,700	$316,840	$422,790	$521,940

To the total of 1896 the contributions were:

Germany	$261,700
Austria	27,450
England	9,740
France	9,640
Sweden	27,520
Switzerland	6,530

Dealing with our principal competitor, Germany, we may mention that the four leading German firms have their own "technical bureaus" in Russia, and thus are in a position to continually watch the market. These companies are: Allgemeine Electricitäts-Gesellschaft, Berlin (capital, $15,000,000); Schuckert & Co., Nuremberg (capital, $12,000,000); Gesellschaft Loewe (Union), Berlin (capital, $10,000,000); Siemens & Halske, Berlin (capital, $9,000,000). (Recently a powerful financial syndicate has put at Siemens & Halske's disposal a further capital of $7,500,000.)

In 1899 an international electrical exhibition will be held at St. Petersburg, and all American manufacturers wishing to get a share of the yearly growing imports of electrical machinery and appliances would do well to exhibit there.

WAR NEWS.

War Taxes.—Now that the stamp taxes for war revenue are in force, all private telegraph messages must have a one-cent stamp affixed. If the copy furnished for transmission is not so stamped, the law requires that the company shall not forward the dispatch. The stamps may be obtained at the Internal Revenue offices, or, in limited number, from the offices of the Western Union and Postal companies. The latter company has issued the following bulletin of information:

The war-revenue law requires that on and after July 1, 1898, under a penalty of ten dollars, no telegraph company, or its agent or employe, shall transmit to any person any dispatch or message without an adhesive one-cent documentary revenue stamp being affixed to a copy thereof, or stamped thereupon. On and after July 1, 1898, the following instructions are therefore to be observed:

The senders of each of the under-mentioned classes of business must be required to attach a one-cent documentary revenue stamp thereto before the message can be accepted for transmission:

A. Full paid messages, day and night.

B. Collect messages.

C. Messages sent under business or half-rate franks

D. All messages sent free, whether under complimentary franks or under special approval of any official of the company.

E. Messages received by telephone from customers direct; the cost of the necessary stamps is to be added to the account rendered.

F. Messages collected in answer to call bells, and on telephone calls; messengers will be instructed to require that stamps shall be placed on the messages by the customers. Messengers will not be allowed to carry stamps to supply customers.

G. Press dispatches: A stamp will be required for each dispatch irrespective of its number of words (or number of addresses). On dispatches transmitted direct from newspaper newspaper offices, a stamp must be attached by the sender to each dispatch, irrespective of the number of words it contains (or number of addresses).

H. The sender of each money transfer shall attach thereto a two-cent documentary stamp for each one hundred dollars or fraction of one hundred dollars, transferred by telegraph.

The law provides that "the person using or affixing the stamp shall write or stamp thereupon the initials of his name and the date upon which the same shall be attached or used, so that the same may not again be used."

The war revenue law does not require that the telegraph companies shall either provide or pay for the revenue stamps that are to be attached to messages on and after July 1st, but that the senders of messages shall provide and pay for them.

In order to avoid inconvenience and delay, it is suggested that patrons supply themselves with a sufficient number of our day and night sending blanks, stamp and cancel them according to the law, and have them ready for use.

Telephone toll messages costing 15 cents or more are also taxed one cent each. However, it is likely that this tax will be borne by the telephone companies. In Chicago, for instance, it is said that the Chicago Telephone, Central Union Telephone and American Telephone and Telegraph companies have agreed that, for the present at least, the change shall make no difference to customers. It is thought probable that sworn returns of the number of messages handled will be made by officers of the telephone companies at stated periods.

On Friday, July 1st, when the new law went into effect, there was a scarcity of stamps to add to the other delays caused by the adoption of the law. However, it was recognized that the tax was a necessary one, and the inconvenience was cheerfully borne.

Much dissatisfaction is expressed because the telegraph companies insist on the tax being paid by customers, and suits to test the legality of their position have been begun in the United States courts in Cincinnati and elsewhere.

Patent Commissioner Duell calls the attention of attorneys, agents, inventors and others to the provisions of the new revenue law in relation to affixing stamps to certain documents that are issued by or registered in the Patent Office. He says: "Notice is hereby given that to all certificates required by law to be issued by this office there must be affixed the proper revenue stamp, to the value of 10 cents, which must be provided or paid for by the party ordering the certificate, and that mortgages of patent rights, and conveyances of such rights 'in trust to be sold or otherwise converted into money, which shall be intended only as security, either by express stipulation or otherwise,' which are offered for registration in this office, and all powers of attorney, must be provided with the stamps required by this act. Unless every such mortgage, conveyance or power of attorney be stamped in accordance with this act it will not be registered or entered on the records of this office, but will be returned to the party offering it for compliance with the provisions of this act."

Searchlights.—The New York Tribune remarks that while the searchlights first and chief mission is to throw shafts of light and to illuminate dark places, to aid in the discovery of prowling ships, torpedo boats and blockade runners, it is used extensively also as a means of communication by signals. But in a night engagement it is used also to dazzle the eyes of the gunners on the opposing side. Bad marksmanship on the part of the Spaniards has often been given as the cause for their ineffectual shooting, while the real cause has been the good work of those who operated the searchlights on the American ships.

The Signal Service.—Capt. John McConnell and 65 men of the United States Signal Corps left Chicago for Washington on June 29th over the "Big Four" road. They are all telegraph operators.

A great deal of credit is due the officers and men of the Signal Service Corps of the army for their unremitting and successful work on sea and land to establish direct communication between the United States army operating at Santiago and headquarters at Washington. The work was done in the enemy's country, under the relentless glare of the tropical sun and amid many other difficulties that can be conjectured, yet electrical communication was established on the field and fairly well maintained. Both the telephone and and the telegraph figured in the result and again proved their inestimable value in military operations.

A Washington dispatch of July 4th states that the officers of the Signal Corps with Shafter's army are keeping pace in establishing telephonic communication in every direction where the army makes its move. On that day a dispatch was received from Major Greene, who is the Signal Corps officer on Shafter's staff, showing that three lines of telephone wire had been stretched and that they extended up to within 200 yards of the advance works of the American army. The officials have an adequate supply of telephones with them, and are putting these instruments up as rapidly as the wires are stretched. Major Greene's dispatch was dated at the headquarters of the army, near Santiago, and came to the United States via Playa del Este. He adds that he found the telephones in the captured Spanish intrenchments of Santiago in perfect form.

Volunteer Engineers.—A commission as captain of engineers has arrived in Chicago from Washington for George A. Hurd. Captain Hurd is the mechanical engineer of the Crane company, Chicago, and well known to electrical men.

The First Battalion of the First Regiment of Volunteer Engineers has been organized at Peekskill, N. Y. It contains many well-known engineers and technical men. Major John S. Sewell is in command.

War Balloons.—For the first time in the history of the American army observation balloons were used in actual warfare in the operations about Santiago, both by the army and naval forces. They are reported to have been very useful, going high in air and giving the officers in them a radius of observation with telescopes of from 20 to 40 miles. Several ascensions were made near Gen. Shafter's headquarters and from the New York, Admiral Sampson's flagship. The balloons were anchored, of course, and the observations were telephoned to the ship or the ground, as the case might be. There is little danger of the balloon being pierced by a rifle shot on account of its constantly swaying motion and the extreme difficulty of hitting anything at an elevation of 2,500 feet, which is the usual limit of the cable reel.

Miscellaneous Note.—Even the men on the ships in Admiral Sampson's fleet have some leisure for study, as was shown by the recent receipt in this office of an order for a complete set of the Electrician Publishing company's hand-book series from a man on the U. S. S. Iowa. The letter was written at Santiago de Cuba.

Electrolytic Iron.

It has long been known, says the Engineering and Mining Journal, that iron, when electrolytically deposited under certain conditions, possesses peculiar properties and a hardness approaching that of steel. Practical application of these properties has been made in the preparation of electrotypes for printers' use. The electrolytic method of preparing steel-faced electrotypes for banknote printing was first introduced into Russia by Klein. The details of the method have, however, not been generally known, and the communication of F. Haber to a recent number of the Zeitschrift für Elektrochemie is therefore of considerable interest. According to this writer, the method in use by the printer of banknotes to the Austrian government is the following: The original plate, prepared for the electrolytic bath in the usual way, is coated with a deposit of iron two millimeters thick by means of the electric current and a bath of ferrous and magnesium sulphates. The rate of deposition is excessively slow, one and one-half months being required in order to prepare a plate of the above thickness. The thin iron electrotypes are then backed by copper in the usual manner. These plates when used for printing give finer impressions, and have a longer life than those prepared by depositing iron upon a copper electrotype, because the printing surface is that which has been in actual contact with the original plate, and also because the iron first deposited is harder than that separated at a later period of the deposition. Haber has also examined the chemical composition of this iron and the conditions that are requisite in order to obtain it of maximum hardness. His analytical work supports the results of the earlier investigations of Lenz, which showed that this iron contained considerable quantities of hydrogen. Percentages varying from .012 to .110 were found, and though these appear insignificant when expressed as weight percentages, they represent volume ratios of H to Fe of between 12 and 110. By use of a very high-current density when depositing the iron from the above solution, Haber was able to obtain deposits containing even more than 110 times their own volume of hydrogen. Thick deposits of iron could be obtained by means of this high current density (2,140 amperes per square foot), if a revolving cylinder were used as cathode. On an ordinary flat cathode the deposit of electrolytic iron for any continued length of time caused curvature concave toward the anode.

Cost of Electric Power at the Lachine Rapids, Canada.[1]

By W. McLea Walbank.

In order to allow of a fair comparison with other plants of the cost of producing power for generating electricity from the Lachine Rapids plant, the writer considers it desirable to give you a brief outline of the hydraulic as well as the electrical equipment of our works.

The world-renowned Lachine Rapids, as you are all doubtless aware, are situated on the St. Lawrence River, a short distance from the city of Montreal.

The idea of converting the wasted energies of these turbulent waters and harnessing them for the use and convenience of man was not new. As far back as 1866 a company was formed, whose object was to erect dams and construct large hydraulic works, about a mile lower down the river, than the site of the present power house, its object being to induce factories to establish their works at the Rapids, for at that date the possibilities of electric transmission had not been demonstrated. The scheme, however, never materialized, and since that date various projects have from time to time been talked of, but never matured.

In the fall of 1895 the Lachine Rapids Hydraulic and Land company commenced its operations. The directors commenced work only after having fully satisfied themselves upon the difficulties to be encountered and overcome, and carefully studying the question of back water, frazil and anchor ice, and went in with a determination to succeed.

The company was honestly formed, without "ground floors" or "sub-cellars," with a bona fide capital, on which every share represents one hundred dollars cash. This, the writer considers, has direct bearing on the cost of producing electricity, because a company handicapped by what is called watered stock or exorbitant promoter salaries has to pay interest on money it never had the use of.

Having therefore formed a company on a solid and firm financial basis, the property fronting on the Lachine Rapids, and controlling the water power privileges, was secured, and operations for the development of the water power commenced.

Hydraulic Development.

The hydraulic plant consists of a main dam and power house, 1,000 feet long, and a wing dam and guard pier 5,000 feet long, forming a head-race or basin with an average depth of 12 feet in low water.

To secure this it was necessary to divert the waters of the St. Lawrence and lay bare the bed of the river for a distance of over a mile and remove over 400,000 cubic yards of rock.

The main dam, which is constructed of a series of isolated cut-stone piers, with head-gates and stop logs, furnishes in all 36 flumes and three waste weirs, at the same time forming foundations for the power house and turbine sheds.

The total development will, when completed, consist of 72 vertical turbine wheels and 12 generators. The wheels are connected in series of six, by gearing, to a horizontal shaft, at the end of which a generator is directly connected. The completed power house will contain 12 such sets.

Of the total installation 48 wheels are already in place, and the power house, head-race, tail-race and dams are completed.

Electrical Equipment.

Each dynamo house will contain four three-phase General Electric alternators, wound for 4,400 volts at full load, and two direct-current exciters at 120 volts. There will be in the total installation three such dynamo houses, containing in all 12 dynamos and six exciters, each exciter being capable of exciting four machines. Each dynamo house will have its own switchboard, of blue Vermont marble, of the very latest design, so arranged that each circuit may be operated from the switchboard of either power house. The floors are of slate and the building of solid brick. The current is generated at 4,400 volts, avoiding the use of step-up transformers, is transmitted on iron poles over bare copper wire to the city of Montreal, a distance of about five miles, to the sub-stations, where the pressure will be lowered to 2,300 volts, and by means of sub-station switchboards subdivided into the desired units and distributed partly through underground conduits and partly by overhead construction throughout the city of Montreal and its suburbs, where we find a population of over 300,000 people offering a market for light and power.

Of the total equipment one-third is already installed.

Total Power.

The wheels were tested at the Holyoke testing flume, on April 16 and 17, 1897, and developed at full gate as follows:

With a speed of 76¼ revolutions, discharging 235.33 cubic feet of water per second and developing 300.84 horse power, showing an efficiency of 81.32 per cent., which would make the total possible output of our power house about 16,000 kilowatts.

Cost.

Perhaps the greatest obstacle to a fair comparison of electric current produced by water power, as against the same current produced by steam, is the first cost. In the former case, especially if a large

1. Read before the National Electric Light association, in Chicago, June 9, 1898.

water power is to be developed, the expense of the whole installation, such as dams, head and tail-races, etc., has usually been made at the commencement, while perhaps only a fraction of the power thus obtainable is at once used, therefore throwing a very much larger capital cost per unit than with a steam plant, which need only install the power necessary for immediate demand and continue increasing or adding thereto, as the demand therefor offers.

In our own case you will notice that it was necessary for us to spend about $1,000,000 in hydraulic development. This million dollars is able to furnish us over 20,000 horse power, whereas it will be some time before we will be able to convince the public of the advantages to be derived from the use of electricity, which is no easy task, as anyone familiar with the subject will bear out.

The 5,000 horse power, from a commercial point of view, will have, for the present at least, to be charged with all the expense of the hydraulic development of over 20,000 horse power.

In estimating the cost of producing power from the Lachine Rapids, the writer does not take into consideration the cost of distributing power, for this would be the same in either case, whether the prime mover was a water wheel or a steam engine. He will therefore confine himself to the cost of developing water power and delivering that power on the bus-bar at the sub-station, exclusive of the generator. He will add the cost of transmission line from the source of power to the sub-station in the city, because this is directly attributable to water power plants, as it would not be necessary in the case of a steam plant, unless it were for transmitting power from a coal mine to a city, or following the practice laid down by the Brooklyn Edison company, in locating their power house at a point convenient for obtaining coal and water at reduced prices, using high-tension transmission and converting by rotary converters at various sub-stations.

There will also be included the step-down transformers to bring the pressure equal to that required for local distribution, namely, in the neighborhood of 2,000 volts.

He will also charge the water power with the drop or loss in power from the rapids to the sub-station.

The writer therefore considers, in justice to the Lachine Rapids plant, it would be necessary to give, first, the cost per kilowatt per year for the portion of the plant at present installed and connected to generators ready for operation, and second, what the cost will be per kilowatt per year when the whole water-power development is in operation.

First—The total cost of water rights, dams, hydraulic machinery, power house, transmission line, step-down transformers, etc., is $957,200.

Power developed, 4,000 kilowatts at the generator. Allowing 10 per cent. loss, there will be delivered at the sub-station bus-bar 3,600 kilowatts, which is equivalent to $263.83 per kilowatt, capital cost.

This, at six per cent., would be equivalent to	$15.95 per K. W.
Depreciation of $300,000, which will more than cover the cost of that portion of the plant subject to depreciation rated at five per cent. and spread over 3,600 kilowatts would be equivalent to	4.17 per K. W.
Operating expenses, including labor, repairs, insurance, amounts to $10,275 per annum, which, divided into 3,600 kilowatts, is equivalent to	2.85 per K. W.
Making a total cost per kilowatt on a 24-hour day basis, per year	$22.97 per K. W.

Second—The total cost per kilowatt with the whole water-power plant in operation.

Before giving these figures the writer would like to explain that the figures herewith quoted are reliable for the cost of the completed plant, inasmuch as the same is at yet present under contract with reputable firms, the Lachine Rapids Hydraulic and Land company having a limited time in which to order the works completed.

The total capital cost with 72 wheels installed will be $1,113,273.

Power developed after deducting all losses will be 13,500 kilowatts at the sub-station bus-bar, equivalent to $82.46 per horse power capital cost, which at six per cent., represents (per annum)	$4.95 per K. W.
Depreciation per kilowatt will equal	1.68 per K. W.
Operating expenses, including labor, repairs, oil and waste and insurance, if taken upon the same basis as already existing, will amount to $20,453, equivalent to.	1.51 per K. W.
Making a total for a 24-hour run per annum of	$8.14 per K. W.

It will be noticed that the operating expenses, as well as the depreciation per kilowatt, in the latter case is very much reduced, and it is a remarkable feature how constant our operating expenses are, even at present, being practically the same with full load as with no load.

In connection with these figures it might be stated that coal used in Montreal and vicinity is what is known as Nova Scotian coal and costs $3.50 per ton for run of mine.

The writer would also draw your attention to the fact that the capital cost cited in each of the foregoing cases includes money paid for real estate, of which the company owns over some 8,000,000 feet, fronting on the rapids, intended at some future date to form the site of a suburban town, and which it is hoped and expected will return the money expended in developing the water power above referred to.

Conclusion.

From the foregoing the writer trusts that he has shown that where reliable water power can be obtained within reasonable distance from power centers it can be made to produce cheap electric current, to say nothing of the great advantages the city must derive therefrom, not only commercially, but viewed from a sanitary standpoint, as well, as the use of electric power thus generated is the best smoke consumer yet invented.

Discussion.

H. A. Wagner, St. Louis: I wish to ask a question. Are the figures given based on the 24-hour use of the kilowatt capacity of the generators or of the station?

W. McLea Walbank, Montreal: The cost that I have given you there is based upon the possible output of a plant, independent of the number of hours that it is used. Our capital cost was a certain amount and we have a certain capacity in electrical generators, and by dividing one into the other you get how much it costs per horse power to develop.

Mr. Wagner: The cost of production per kilowatt-hour must be based on the cost of production of the kilowatt-hours delivered, and not on the possible kilowatts which could be delivered if you could find people to use it.

Mr. Walbank: I believe we are going to keep our plant running pretty nearly to full capacity. We have in Montreal 30,000 horse power in steam at the present time. We have the street-railway company using 5,000 horse power in steam. We have the water-works pumping all day. And there are a lot of other sources which will take power, which we can take and operate at pleasure and keep them loaded up; you can do it when you want to.

L. A. Ferguson, Chicago: It seems to me that the figures $10,275 per annum are very small for the operating expenses of a plant such as is described by Mr. Walbank. The figures on the cost of the kilowatt-hour are based on full load, running the machinery at full load 24 hours a day. That would give an output of 31,000,000 units a year, which is double the output in Chicago, and I am sure we could not begin to operate our plant for anything like that amount. I do not see how it can possibly include any portion of the general expense.

Mr. Walbank: Mr. Ferguson does not understand the point. This is not for the production of electricity; it is the production of power for generating electricity. It is simply the operatng expenses of the power station at the Rapids. All that is required to operate that plant to-day is three switchboard men, one day man at the water wheels and one night man at the water wheels and a man to clean around. The figures are actually taken from our books.

Samuel Insull, Chicago: Suppose a man wants power for three or four hours a day; will you sell it?

Mr. Walbank: Yes; for a minute, if he wants it—at any time he wants it, flat rate or by meter; one lamp or 5,000 horse power.

Mr. Insull: How are you going to protect yourself on the question of maximum load? By difference in rates?

Mr. Walbank: We have, of course, difference in rates.

Mr. Wagner (to Mr. Insull): You showed us forcibly on the diagram which you discussed at some length the large proportion which the interest charge on the investment compared to the total cost of operating, all expenses included. The only saving to be effected in water-power distribution, as compared with distributions from central stations by steam, is the item of coal.

Mr. Insull: That is one-sixth of the interest; that is all.

Mr. Walbank: How about engineers, etc.?

Mr. Wagner: The labor item which would be eliminated by the use of water power would necessarily have to go into the fuel account, and we might increase that to one-quarter, instead of one-sixth, and say that the water-power plant cost 25 per cent. more than the steam plant; in which case the cost of operating and the production of current per kilowatt-hour would be approximately the same.

Mr. Walbank: Then there is depreciation on the steam plant as compared with nothing on the water plant.

Mr. Ferguson: To compare a water-power plant as described by Mr. Walbank with a steam plant. I would like to present as a permanent installation one equal to that outlined by Mr. Walbank—our system in Chicago, represented by the Harrison street station; and I think all who have seen that plant will agree that that station is quite as permanent from the standpoint of investment as the system outlined by Mr. Walbank. To show the comparative cost of producing a kilowatt-hour I would like to offer some figures. The cost of the station, including the transmission line, is $1,200,000; the interest on that amount will be $72,000; the total cost of operating at the switchboard of that station is $77,000 per year; the two latter items, added together, make $149,000. Taking the same percentage for depreciation that Mr. Walbank does, we have a depreciation of $20,000, making the total operating cost $169,000. The total power [illegible] station is 7,000 kilowatts, [illegible] per kilowatt in that station would be $24 [illegible] $22.90, stated by Mr. Walbank [illegible] in cost in generation of [illegible] that of a first-class steam plant [illegible]

Mr. Walbank: What price do you [illegible]

Mr. Ferguson: $12 a ton.

Mr. Walbank: We pay $3.50 a [illegible]

J. G. Fakes, Oklahoma City: What [illegible] ence in depreciation on the water-power plant and an ordinary steam plant?

Mr. Walbank: I could not tell you what the depreciation of a steam plant is, but as I consider the depreciation in a water-power plant, there is practically nothing to depreciate. I do not think our expenses for depreciation amount to anything.

E. H. Davis, Williamsport, Pa.: I ask whether you have made any calculation as to the cost of power on the basis of operating 3,000 kilowatts 10 hours each day, including Sunday, and 25 per cent. of that number of kilowatts for 18 hours?

Mr. Walbank: I am not writing on the cost of distributing power, but on the cost of generating power.

Mr. Davis: I wanted to know as to the fact whether any calculation had been made on the basis suggested of a maximum load for 25 per cent. and 900 kilowatts for 18 hours.

Mr. Walbank: Probably in five years we will be able to answer that question, after we have had enough experience.

Mr. Davis: What is the kilowatt charge?

Mr. Walbank: It varies from one-half cent up to four or five cents, depending on the probable use to be made of the current.

Mr. Ferguson: I think in these figures Mr. Walbank has left out an important thing. We ought to know what the load-factor of the system is, because the figure of $10,000 is proportional with his output or it will vary with the output, so that the load-factor is now only 10 per cent. It is hardly fair to compare the cost he has presented with a system having a load-factor of 25 per cent. I took a station of 25 per cent. If it was only 10 per cent., then, of course, the output per kilowatt would be less, and the figures would be still more favorable to the steam plant.

E. V. Matlack, St. Louis: There is a water-power plant not far from Chicago. It was started with four No. 10 old-style machines, and the theory was that it would cost very little to operate it. The experience they had with the water-power plant, with the interruption and unreliability of it, made it necessary to displace it with a steam plant. The difficulties were from obstructions getting into the wheels and making it impossible to shut the wheel off and turn out the lamps; also anchor ice, which would clog up the racks in front of the wheels and shut the water off; and another peculiarity was that they had a school of eels that went into the rack and shut down the plant. They had a method of shutting down once a year for cleaning out the wheel-pits, and it made it very inconvenient for the electric-light customers. As has been stated, these water-power plants must be designed for the maximum capacity and investment made for the total load. Mostly all steam plants have started in with a few hundred horse power and grown up. Under these conditions, the original interest charges put into the investment of a water-power plant must be carried at a light load, and therefore the water-power plant would be a very expensive investment unless there was business from the first to earn a return for the outlay.

Mr. Walbank: Had the water plant you referred to any rack in front of it? How did the eels get in?

Mr. Matlack: They went through the rack. Ten bushels were taken out.

Mr. Wagner: I think we all appreciate that in the next few years water-power stations will be developed over the country to a very large extent, and we are all very much interested in the engineering details that have been so neatly worked out by Mr. Walbank in Montreal, and the system stands undoubtedly as one of the foremost electric water-power installations so far produced; but when it comes to the question of cost of operation and distribution, of the total cost per unit of power furnished from such installations we should like very much to see them based on somewhat similar lines to that upon which we are accustomed to have the records of steam-power plants. We have a more or less uniform system among our central stations for showing the cost of production per kilowatt-hour delivered from the station, and if the water-power plants could use the same general forms to show their total costs, the comparison would be more instructive.

Mr. Davis: What would be your price to a customer who would guarantee to use 100 horse power for 10 hours a day per working year? What would the rate per horse power be?

Mr. Walbank: Anywhere from $32 to $36.

C. W. Rice, New York: I would like to ask, What is the regulation in the station?

Mr. Ferguson: You mean electrical regulation of water wheels?

Mr. Rice: I should like Mr. Walbank to speak of both mechanical and electrical.

Mr. Walbank: As far as the electrical regulation is concerned we have none, because we only opened last December, and the special station switchboard is not up yet. What our ultimate regulation will be is pretty hard to say. I wish to correct a remark

made by Mr. Wagner when he said that we operated principally for the supplying of power. We are operating about 30,000 incandescent lights now, with very little power. We have 300 series arc lamps, 75 to 100 alternating arc lamps, with one or two of the enclosed type. We were originally operating a single-phase plant from steam, and we found what our coal cost us then. We shut down the steam plant and started up the three-phase plant from the Rapids and used the same switchboard that we were operating the steam plant with, and converted our power down to the two-phase, and connected on that switchboard and brought one leg out in one direction and the other leg out in the other direction. We are operating now with the same generator another plant at the northeast end of the city and through the suburbs of Montreal; and I do not think we have any complaint of the regulation, and the three-phase is as good as single-phase for every purpose.

H. S. Anderson, Springfield: I represent a company located at Springfield, Mass. One year ago we completed a water-power installation of a capacity which is equal to that of the steam station which we ran before. I found that with a maximum capacity of water wheels of 2,800 horse power we were able to deliver 1,000 electrical horse power six miles from the water-power station. I also found that to operate that station it cost $6,000. According to my calculation that is about $8 per kilowatt delivered, for operating expenses. These operating expenses do not include any cost of repairs, which are are not yet necessary. My company pays the company that owns the water-power privilege $9.23 a mechanical horse power delivered to its shaft. To deliver an electrical horse power at the end of the line, deducting for losses, costs us about $12 an electrical horse power. That makes it $21.23 for an electrical horse power delivered, with no allowance made for depreciation or the cost of repairs or interest. The company built a power station costing approximately $150,000 with capacity of 2,800 horse power. The company pays to the company owning the water privilege an amount of money which represents an investment of about $200,000. The depreciation factor we can only guess. I may say here that the load on that station consists of some seven hundred 1,200 candle power street lamps, which burn 4,000 hours a year, including all night; also a maximum incandescent load of 600 amperes and a motor load which is on from seven o'clock in the morning until six o'clock at night, of about 200 horse power actually delivered, beside a load of 200 horse power of commercial arc lighting; so that we take in all classes of work. We find that with our maximum of 2,800 horse power, which represents the maximum load at the water power station, we can deliver 24 hours a day an average of 1,000 horse power.

Mr. Davis: I ask the last speaker whether he is willing to state the difference in the net result to him before and after installing and operating the water-power plant.

Mr. Anderson: We have found that the change of our station from the steam plant to the water-power plant has resulted in a very great saving; and we have also found that we were able to deliver nine-tenths approximately of our whole sold output from the water-power plant.

A Meteorological Dictum.

The following observations, apropos of what is usually called "heat lightning," are credited to an "observant Jerseyman" discovered by the New York Sun:

"There never is any lightning without rain," said the Jerseyman. "My father made that discovery when he was a telegraph operator. That was in the early years of telegraphy, nearly 50 years ago In those days there was no such thing known as reading by sound, and all the operators used recording instruments. The crudeness of the instruments in those days made it very difficult to operate the lines except under the best circumstances, and utterly impossible, even with careful adjustment, when there were electrical storms.

"My father began experimenting to overcome this difficulty, and at last he made a self-adjusting relay magnet which would not only work on any line, long or short, without any manual adjustment, but it would also work just as well when the line wire was overcharged by aerial electricity, and the working of the key merely made slight differences in the amount of the current on the line. At these times he could receive messages from anyone on the line, although they could not get messages from him, as they had only the ordinary relay magnets.

"His ability to take messages under such circumstances soon became known all along the line. His office was at Perth Amboy, N. J. One day it occurred to him to inquire into this question of heat lightning, and, seeing a storm away off in the west, he telegraphed along the line, asking all the offices where the storm was. He got answers from all the offices up to that which was cut off by the presence of the storm, and then requested each office between to tell him when the storm arrived there. So as the storm moved he got a history of it.

"This he repeated many times, and by means of questioning along the line afterward also made sure that there was always rain falling where the lightning was central every time the flashes were visible to him, although no rain might fall at Perth Amboy for days or weeks."

Legal Duties and Responsibilities of Electric Companies.

The Supreme Court of Oregon gives particularly careful consideration to questions relating to the duties and liabilities of electric companies, as presented by the case of Perham against the Portland General Electric company, not only because the questions are important, but also because many of them are new or "of first impression" in that state.

Action was brought to recover damages for a death alleged to have been caused by the negligence of an electric company. The man killed was in the employment of a suburban railway company while engaged in repairing its bridge, over which the electric company had placed wires, two of them, in particular, but two feet apart, under a license from the railway company.

It was undisputed that the wires referred to were placed by the electric company in a position where they would probably be exposed to contact by persons working on the bridge, although the company knew that it would be necessary to repair the structure from time to time; and it admitted and alleged that it was not practicable, in the present knowledge of the science of electricity, to insulate wires so as to make them safe and not dangerous to persons coming in contact with them when charged with a high voltage. This was sufficient, in the opinion of the court, to make out a prima facie case of negligence, because it tended to support the main ground of recovery relied on in the case, viz., that, although the electric company knew it would be necessary from time to time for the railway company to send men on top of the bridge to make needed repairs, it placed its wires to be used in the transmission of such a high voltage of electricity as inevitably to cause the instant death of any person coming in contact with two of them at the same time in such a position that it was impracticable, if not impossible, to make such repairs without doing so.

Of course, it was argued, on the other hand, that the man was guilty of contributory negligence (1) in going on top of the bridge to work without ascertaining from the electric company, or someone having knowledge on the subject, whether it would be safe to come in contact with the wires, and (2) in attempting at the time of the accident to cross from one side of the bridge to the other by walking on the top lateral braces and stepping over the wires, rather than crossing on the end-strut brace and under the wires. Both of these contentions proceeded on the theory that he was chargeable with knowledge of the fact that the wires were dangerous, and, having voluntarily exposed himself to the risk of contact therewith, must take the consequences of his own conduct. The Supreme Court agrees that he was unquestionably guilty of negligence if he was to be charged with knowledge that the wires, although apparently harmless, were in fact dangerous, for he could have avoided coming in contact with them. The court holds that it cannot be ruled as matter of law that he was negligent in going on the bridge to work or in crossing on the top lateral braces, if the electric company owed to him the duty of exercising reasonable care to prevent injury to him from contact with its wires while at work.

There was nothing to support any claim in this case on account of any special knowledge of electricity or its effects which the man possessed, or on account of his having any knowledge that these wires were in fact dangerous, and, as he was not the agent or servant of the electric company, the court says that he was not, in its opinion, chargeable with such knowledge.

Furthermore, the court rules that he was not a trespasser or licensee bound to take the premises in the condition in which he found them, and that the familiar rule that one who deliberately goes into a place of known or apparent danger and is injured must take the consequences of his hardihood could have no application here, because there was in fact no apparent danger, but, on the contrary, so far as a non-expert could ascertain from an examination, the wires were entirely safe, and in perfect condition. He had a right, therefore, to believe that the place was safe and to assume that the electric company had exercised due care and caution to prevent injury to him, and had not placed on the bridge, in such a position that he would likely come in contact with them, wires which it knew to be dangerous.

This leads the court on to state that the electric company was using the bridge by permission of the railway company for the support of wires used in the transmission of a highly dangerous, subtle and invisible force, and was, therefore, chargeable with the duty of placing and keeping them, as far as practicable, in a condition to avoid injuring the servants of the railway company while at their work. Its duties in this respect were similar to those of an electric company, which, by permission of the owner, places its wires over the roof or attached to a house or building; and in such case, continues the court, the rule is quite universal that the company is liable to the owner and his servants for an injury received through its negligence by contact with such wires when making needed repairs or improvements to the building, if the injured party is in the exercise of due care and caution at the time.

Then, it being admitted that, although the wires in question were insulated, such insulation was no protection whatever to persons coming in contact with them, the court holds that the negligence of the electric company was equally as great, if not greater, than if the danger had been from absence of insulation. The apparently perfect insulation was calculated to deceive and to cause one unfamiliar with the facts to suppose the wires safe. It acted as an invitation to persons at work in and among the wires to risk the consequences of contact therewith. Under such circumstances, and with the electric company knowing that the insulation afforded no protection, and yet putting its wires in a place where the servants of the railway company might come in contact with them while in the performance of their duties, and without giving any warning or notice of the danger whatever, the court insists that a jury would certainly be justified in finding that it did not exercise due care and caution in so doing, as it found in this case.

Electric companies, of course, the court goes on to say, are not bound to have perfect apparatus or perfect construction, but they are required to exercise a degree of care and prudence in the construction and maintenance of their wires commensurate with the danger, and where their wires are designed to carry a strong and powerful current of electricity, so that persons coming in contact with them are certain to be seriously injured, if not killed, the law imposes upon the company the duty of exercising the utmost care and prudence to prevent such injury; and whether such care has been exercised in a given case is ordinarily for the jury to determine.

The Supreme Court also approves of an instruction that was given the jury, which was, in effect, an application to this case of the general rule that the care demanded of electric companies must be commensurate with the danger, and that, where their wires are carrying a highly dangerous current of electricity, as was admitted to have been carried over these particular wires, the law imposes upon the company the utmost degree of care in their construction, inspection and repair, so as to keep them harmless at places where persons are liable to come in contact with them.

Telegraphing in Spain.

The Spanish ceremonies which accompany the handling of a telegram would be amusing were they not so irksome and time-killing, says a correspondent of the London Telegraph. You approach a little window in the one office in the city, and, when your turn comes, hand in your message. The clerk counts the words a couple of times over, adds up the result of each page, refers to the written tariff and finds out what the cost is in francs. Then he takes another slip of paper, finds out what the rate of exchange is at the moment and reduces the francs to Spanish pesetas. Finally, he reads out the result—say, 597 pesetas 35 centimes. You engrave these figures in your memory and, leaving the hall, go to another window in a passage outside, and there await your turn, repeating always the number 579.35 till the clerk asks you what you want. Then you explain that you are come to purchase Spanish stamps for the sum of 597 pesetas and 35 centimes, and you take out a note for 1,000 pesetas. The passage is dark on the brightest day, and you accept the stamps and your change in a spirit of true religious faith, for you see not even darkly as in a glass. When you return to the inner sanctuary, awaiting your turn again, the chances are that you find yourself short of stamps, in consequence of a mistake on the part of the clerk outside. This happened twice to me, but I am bound to say the individual discovered and rectified his error, so that my only loss was of about 35 minutes more.

But the most curious thing of all is the process of recovering your money if the telegram be suppressed. There is no way of obtaining it speedily. You must wait. Messages of mine to the value of several hundred pesetas were stopped, and I called at the office for the money. In Russia, Germany, Turkey, Austria—everywhere, in fact—the money paid is refunded at once. But not so in Spain. Here you have to make various pilgrimages, from post to pillar, interviewing officials, dignitaries, clerks, porters. All shake their heads, shrug their shoulders, purse their lips, and assure you that the government allows them no special funds for the purpose. "Yes, but if you do not forward my message, for which I paid you in advance, you have no right to keep my money." "Oh, no! of course not. We are not to blame, you know. You had better see our chief. He is very busy now, but if you call to-morrow I am sure you can see him."

I spent four days in journeying from chief to subordinate, and from subordinate to chief, and at last I received the following satisfactory promise: "If you will write a petition to the chief of the telegraph, asking that the money be refunded you for the suppressed messages, he will deal with it in due time." "What is due time?" I ventured to inquire. "Well, we cannot promise anything," said my informant, Senor Perez, except that, when the funds allow it you shall have your money back." "But could you, perhaps, say approximately when?" He could not, but another official could and did —"Any time between two and four months!"

Such a specimen—a tame, humdrum specimen—of the methods of procedure in the constitutional kingdom of Spain, under the most liberal of liberal governments, in the cultured capital of Madrid. What takes place in the provinces and what took place in Cuba we cannot affirm with certainty, but here the old proverb undoubtedly holds good: "If they do these things in a green tree, what shall be done in the dry?" Spain has truly fallen upon evil days.

CORRESPONDENCE.

New York Notes.

New York, July 2.—An interesting story is told in connection with the running of the first car over the new Westchester County electric railway connecting White Plains and Mamaroneck. The car was run on Thursday night on a wager, according to a brief account published in the Sun. H. G. Jennings of this city, treasurer of the road, and Postmaster Clarence McClelland of Mount Vernon, a director, discussed some time ago the time when the road would be completed. Mr. Jennings declared he would have a car run over the line before July 1st, while Mr. McClelland said it was an impossibility. A bet of $250 each was made, and it was agreed that the loser should also entertain the directors of the company at dinner at the Manhattan Hotel. On the night of June 30th Mr. Jennings invited Mr. McClelland and several friends to Mamaroneck, where they arrived at 10 o'clock. Mr. Jennings expected a car at that time, but no car appeared. Minutes grew into an hour. The often-consulted watches showed 11:45 when a car was seen approaching from White Plains. Watches in hand, Mr. McClelland and Mr. Jennings awaited the arrival of the car at the Mamaroneck depot. It was 11:55 when the car arrived, and Mr. Jennings won his bet on a margin of five minutes.

Albert Johnson, president of the Nassau Railroad company of Brooklyn, has invented a new form of convertible car, to be closed in cold or stormy weather and open at other times. President Johnson proposes to build 180 of these cars this summer, and to transform as many of the old-fashioned open cars into the new style. The car is said to have the advantage over the ordinary closed car that it will seat 50 passengers, while the old will seat but 26 people. "I hope by this car," said President Johnson, "to double our carrying capacity in the winter time, while giving passengers more room. I shall have 300 of these cars ready for the winter traffic." The car is heated in winter by electric heaters under the cross seats.

A mortgage for $1,500,000, executed by the New York and North Shore Railroad company, was filed in the office of the clerk of Queens County at Jamaica, L. I., on Thursday. The mortgage names the New York Security and Trust company as trustee to secure the payment of 1,500 30-year gold bonds of the denomination of $1,000 each. The New York and North Shore Railroad company is a new corporation, organized by the managers of the New York and Queens County Trolley company, which owns the trolley lines in Long Island City. The money accruing from the sale of the mortgage bonds will be used for the purpose of building a trolley road from the terminus of the New York and Queens County road at Calvary Cemetery through the town of Flushing to Flushing village. The company also proposes to build an extension from Flushing to Whitestone, and from that place on to Bayside and Manhasset. The corporation claims to have all the necessary franchises, and will commence operations just as soon as it receives a permit from the state railroad commisisoners. The plan is to create a trolley system with transfers throughout Queens County.

William J. Landy, a telegraph operator, committed suicide on Friday night in the Western Union building by shooting himself. Landy had been in the employment of the Western Union company for 35 years. He was considered one of the best telegraph operators in this city. For 18 years he operated the Pittsburg wire at this end. He was frequently suspended because of irregular habits, but always managed to get back until last week, when he was finally dismissed from the service.

Mr. Orr again presents his compliments to Mr. Gould in the rapid-transit controversy and states that the commissioners will not recede from their position that the West street route, if accepted alone, shall pay a rental of five per cent. of the gross receipts. Mr. Orr concludes his letter thus: "If your company is not prepared to meet the views of the board in respect to the matters above stated, as to which the board has now reached and expressed to you its deliberate and final conclusions, it would appear to be futile to continue the present negotiation." M. S.

PERSONAL.

H. D. Sloat, manager of the Postal Telegraph company's office in Kenosha, Wis., has been given the management of the company's office at Janesville, Wis.

ELECTRIC RAILWAYS.

The Denver City Railroad company desires a franchise necessary to enable it to supersede its cable system by electric traction.

It is announced that the street railway of St. Cloud, Minn., will pass into the hands of the Benton Power and Traction company, a new company recently organized. It is now owned by Jared How of St. Paul.

The Fort Scott (Kan.) Rapid Transit company's electric road, operated by the Davenport (Ia.) Investment company, has been sold to the Citizens' Railway company, composed of local men and recently organized.

The United States Senate has passed a bill authorizing the Eckington and Soldiers' Home Railroad company to use the underground conduit system on its line. A bill has also passed allowing the Belt Railway company to use an underground electric system.

The Syracuse Construction company of Syracuse, N. Y., is erecting new buildings in connection with its electric-railroad plant. The buildings consist of a boiler house 60 by 90 feet, which is an all-fireproof building, having steel framework covered with corrugated iron on the sides and roof. There is also an engine room 65 feet wide and 80 feet long, having a steel framework and brick sides. The other building is a car barn and repair shop, 65 feet wide and 170 feet long. This building also has steel framework construction, with corrugated iron sides. All these buildings have been designed and are being erected by the Berlin Iron Bridge company of East Berlin, Conn.

Two corporations, the Tokio Electric Railway company and the Tokio Electric Car Railway company, have been organized for re-equipping existing horse car lines in Tokio and building new lines of electric railway. The former company has at present a capital stock of $2,500,000 and will control all lines in the eastern half of the city, aggregating 100 miles of track to be built within five years. It will change 20 miles of horse-car line to electricity. The second-named company will operate the lines in the western portion of the city. Additional roads aggregating about 200 miles will be taken up by each company upon the completion of the first 120 miles by each. An estimate on the first 50 miles of road, including the entire equipment of cars and the power station, is placed at $2,500,000. A central power station will be built on the river, about five miles from the center of the city, and power will be delivered to the trolley lines by eight transformer stations placed at convenient points in the city. The streets are mainly 60 feet in width and the roads will be double-track. There is also in contemplation a suburban line between Tokio and Yokohama, 18 miles in length, paralleling a steam railroad. In nine other cities and towns in Japan arrangements are being perfected for the construction of a sum total of 135½ miles of road.

TELEPHONE.

The Fergus Falls Telephone company has been granted a right-of-way through Elizabeth, Minn.

A telephone line has been put in between Lohrville, Ia., and Eads, to connect with the line to Lake City.

The Northwestern Telephone Exchange company is constructing a long-distance line from La Crosse, Wis., to Spring Valley, Minn.

The council of Duluth, Minn., has rejected the application of the American Telephone and Telegraph company for a long-distance connection with that city.

The Home Telephone company, New Albany, Indiana, has purchased ground and will erect a building exclusively for the use of the company. Preparatory to moving its exchange, it is putting up considerable cable, using the terminals of the Sterling Electric company of Chicago.

POWER TRANSMISSION.

The T. A. Gillespie company is getting right down to work on its contract to complete the Massena power project. J. B. Walker, who was the engineer in charge of construction under the Lehigh Construction company, has been engaged by the Gillespie company to act in the same capacity, and he has arrived at Massena. He will first direct his attention to building the railroad bridges. The graders and scrapers have arrived, and have been set to work. Some of the steam shovels to be used will be brought from Ogdensburg by water.

Within a short time the plant of the Colorado Electric Power company will be in operation and furnish power and light to the mines and mills of the Cripple Creek district, transmitting the energy a distance of about 20 miles. This plant is one of the largest of its kind in the Rocky Mountain region. The engines and generators are intended to develop power for a hundred plants of mining machinery and as many concentrating plants and ore-treating institutions, besides furnishing them all with light. The buildings cover about half an acre of ground, and in their construction were used 350,000 brick, 3,000 perch of stone, 1,150 barrels of cement, 120 tons of structural steel and a carload of corrugated iron. The boiler room is equipped with four Heine boilers with a combined capacity of 1,200 developed horse power and two Snow air and circulating pumps. In the engine room there are three Hamilton-Corliss engines of the cross-compound type and three Westinghouse three-phase generators of 470 kilowatts capacity. Four Westinghouse converters occupy the converter room. Mr. H. R. Sterling, formerly of the Denver Consolidated Electric company, is the general manager for the company at Cañon City, and C. B. Wilson, at one time first engineer on the U. S. S. Marblehead, will have charge of the machinery.

ELECTRICAL SECURITIES.

The readjustment of the securities of the Massachusetts Electric Railroad company and the various companies leased or controlled by it is practically completed.

The Detroit, Lake Shore and Mt. Clemens Railway company has made a mortgage with the New York Security and Trust company to cover an equal amount of bonds. Part of the proceeds of the bonds is to be used in retiring the bond issue of $260,000, dated July 1, 1897. A sinking fund is to be created for the payment of $5,000 annually, after 1901.

The North Shore Traction company reports gross earnings for May of $118,055, a decrease of $1,75[illegible], as compared with the same month of last year, and net $47,157, an increase of $505. For the eight months ended May 31st the gross earnings were $849,329, an increase of $28,056 as compared with the corresponding period of last year, and net $303,948, an increase of $5,560.

The New Orleans Traction company reports gross earnings for May of $127,290, an increase of $5,883 as compared with the same month of last year, and net $52,383, an increase of $9,757. For the five months ended May 31st the gross earnings were $568,731, an increase of $25,646 as compared with the corresponding period of last year, and net $238,802, an increase of $47,629.

MISCELLANEOUS.

The Green Bay, Wis., Gas and Electric Light company has passed into the hands of Sinclair Mainland and his brothers.

There is some talk of the establishment of a Department of Electricity to be under the government of the District of Columbia. There are large and varied electrical interests in Washington, and they are constantly growing, so much so that there is a frequent clashing of interests, and it is believed that this could be obviated by the organization of a department of electrical control, with some competent and trained person at its head. The matter has been referred to the district attorney to discover whether there is any reason in law why such a department should not be formed.

A railroad contemporary notes that the Baltimore and Ohio Southwestern is the first road, so far as learned, to do its passengers the very simple, but very important, favor of cooling sleeping cars in stations at night. At Cincinnati, Louisville and St. Louis sleeping cars are placed in the stations at 10 p. m., not to depart until after midnight, and in order to make them comfortable and cool 16-inch rotary electric fans are placed in each end of each car, thus removing the heated and impure air from all parts of the car. The fans have been in operation about two weeks, and have been the subject of many favorable comments from passengers.

TRADE NEWS.

Eugene Munsell & Co., of 117-119 Lake street, Chicago, are sending to their western customers a neat blotter, on which are embossed the Cuban and American flags, under which are the words, "Victorious on Sea and Land!" The printed matter beneath these words refers to the rapid development of a great business in a great city.

A meeting of the shareholders of the Phœnix Carbon Manufacturing company will be held at the office of the company at the corner of Broadway and Locust street (American Central building), in St. Louis, on August 31st, for the purpose of considering a proposition to increase the capital stock of the company from $160,000 to $500,000, and also to consider any other matter which may properly be brought before the meeting. Increased capital is made necessary by the growing business of this flourishing company.

The Ohio Electric Specialty Manufacturing company of Troy, O., wants it known that the Perfection dynamo brush still continues to be known by the old name, and it points out that improvement on perfection is impossible. This company is the original manufacturer, it states, of the style of brush known as "Perfection," composed of leaf copper, wire gauze and graphite. It desires the Western Electrician to warn its readers of "cheap imitations placed on the market by irresponsible parties," and says that it is having a greater rush of business than it ever experienced before.

BUSINESS.

Since its consolidation with the American Rheostat company, the Cutler-Hammer Manufacturing company of Chicago has been working overtime to fill its orders promptly. The foreign trade of the company is large, and if the business continues to increase the company will be obliged to seek larger quarters.

The boats of the Detroit and Cleveland Navigation company give opportunity of a delightful cruise

up the great lakes. The prices for fare, meals and berths are reasonable. An attractive illustrated pamphlet is sent for two cents by A. A. Schantz, the general passenger agent, Detroit, Mich.

Every spring and summer season brings the advent of a number of new devices for lightning protection. Many of these are on the market for only one season and are then not heard from again. It is probably this fact that gives the Electric Appliance company great satisfaction in calling attention to the swinging-ball lightning arrester, which has now been on the market for nearly 10 years with uniformly successful results. It is made in practically the same way to-day as when first put on the market, showing that the inventor evidently succeeded in producing a satisfactory device. The Electric Appliance company, as general western agent for this lightning arrester, carries a large stock in Chicago, and reports that each year brings an increased sale of this specialty.

The Mica Insulator company of New York and Chicago, reports a gratifying demand for its micanite segments for electric-light and power generators. Some heavy orders are being executed at the factory in Schenectady, N. Y. Many of the large generators now under construction have for their commutator insulation micanite. The heavy increase of the company's business during the last few months is largely due to the improved process of manufacturing a perfect commutator segment. This company offers to send free to any machinery builder or electrical repair concern a set for any one of the smaller machines free of expense. Those interested in the economical insulation of electrical machinery will do well to write the company at its office, either in New York or Chicago.

The Warren-Medbery company has about completed the addition to its new works at Sandy Hill, N. Y., and is now setting up some very heavy machinery to be used in the manufacture of inductor alternators. The sale of these machines is rapidly increasing, and the works are running to their utmost capacity. The line of knife switches manufactured by the company is very extensive, and the demand is improving.

ILLUSTRATED ELECTRICAL PATENT RECORD.

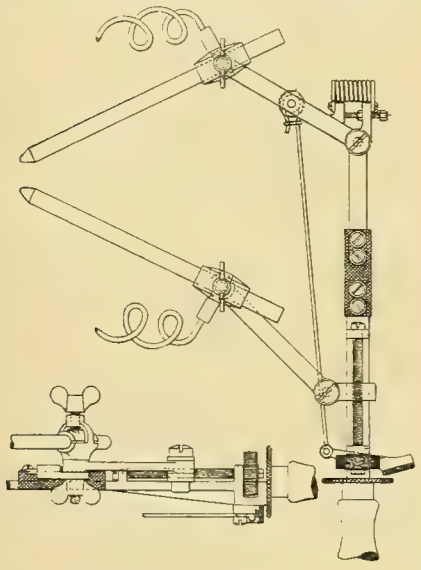
Issued June 28, 1898

606,199. Instrument for Calking Ships. Warren P. Freeman, New York, N. Y. Application filed June 22, 1897.

The reciprocating tool holder of this calking device is operated by an electric motor having two armatures. It is mounted on the motor shaft between the armatures, and is geared to have a rapid reciprocating motion.

606,208. Transformer Box and Hanger. Ludwig Gutmann, Peoria, Ill. Application filed November 22, 1897.

A device for suspending transformer boxes is described.



NO. 606,342.

606,279. Electro-mechanical Musical Instrument. George H. Davis, New York, N. Y. Application filed May 1, 1896.

Essential features are a continuously rotating friction drum, a vertically movable striker rod arranged in close proximity to the friction drum and an armature connected thereto, the striker rod being arranged to engage and actuate a sounding device when raised, an electromagnet disposed opposite the armature and operating, when energized, to draw the striker rod into frictional engagement with the rotating friction drum, and means for automatically making and breaking the magnet circuit at predetermined intervals.

606,285. Telephone System. Wictor A. Gustafson, Joliet, Ill. Application filed August 13, 1896. Renewed January 11, 1898.

The telephone transmitter is supported by means of a pivoted arm and adapted to be turned out of or into service, and adapted when turned out of service to automatically break the primary telephonic circuit, and make the bell-call circuit, and when turned into service to automatically make the primary circuit and break the bell-call circuit.

606,312. Electric Igniter for Gas Engines. Arnold J. Tackle, Oakland, Cal. Application filed October 5, 1897.

A bushing extends into the cylinder or combustion chamber through which a stem actuated by some moving part of the engine passes, carrying upon its inner end an electrode connected to one terminal of an electric circuit, a spring-controlled stem having a bar coming in contact with yielding pins rigidly fastened to its outer end, passing into cylinder or combustion chamber through a sleeve mounted in an insulated bushing and carrying upon its inner end an electrode for yielding engagement with the first-mentioned electrode, which may travel in either direction and being connected with the other terminal of the electric circuit.

606,329. Printing Telegraph. Byron A. Brooks, Brooklyn, N. Y. Application filed January 20, 1894.

In a printing telegraph, a combined transmitter and distributer, comprising a continuously revolving shaft, a set of key levers, a circuit changer or changers and mechanism between the levers and shaft whereby the depression of any key changes the circuit to send an impulse over the line after a predetermined time corresponding to the key.

606,330. Electro-hydrostatic Automatic Car Brake. Jules Buchel and Frank McGloin, New Orleans, La. Application filed May 22, 1897.

One claim reads: In an automatic car brake a closed liquid circuit, a pump for circulating the liquid, a connection leading to the brake cylinder, a controlling valve in the liquid circuit, a weight tending to keep the valve closed, an electromagnet operating said weight and means for making or breaking the electrical circuit whereby the valve will be closed or allowed to open.

606,342. Apparatus for Welding, Brazing and Soldering by Electricity. Albert Hirsch, Berlin, Germany. Application filed December 21, 1897. Patented in England October 16, 1895.

A hand-tool having carbon holders for welding by the electric arc is described. It is suitably insulated and provided with mechanism for striking and regulating the arc.

606,356. Electrical Sign. Mortimer Norden, New York, N. Y. Application filed April 12, 1897.

The combination with a monogram of electric lamps and circuit connections to and from the same, of bars and spring contacts carried by the bars, a shaft, heads, letter bars and contacts upon the letter bars and means for revolving the same and closing the circuits to the electric lamps by the pins acting upon the pairs of contact springs, a segment bar and contact brush in the main circuit for closing the circuit through the spring contacts and for breaking such circuit when the segment separates from the contact brush.

606,369. Current Indicator. Thomas W. Varley, New York, N. Y. Application filed July 2, 1897.

The combination with two astatic needles and a pivotal support, of a connection between the needles extending laterally, an arm for indicating the extent of movement and a case or support for the pivot open between the astatic needles for allowing the ammeter to be applied with the needles at the opposite sides of a stationary conductor.

606,386. Gas Engine. Thomas H. Hicks, Fort Wayne, Ind. Application filed November 29, 1895.

One claim describes the combination with a power-producing engine of two sets of electromagnetic devices for controlling the speed of the engine, an electrical work-circuit, and a supplemental series coil arranged in linear series with the work-circuit, this series coil acting in combination with the electromagnetic devices in controlling the speed of engine.

606,405. Alarm System. Clyde Coleman, Chicago, Ill. Application filed September 3, 1897.

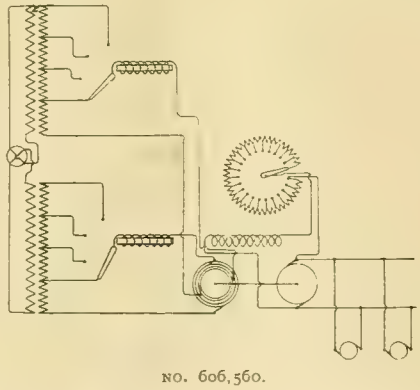
This invention is right up to date. The vault or other inclosure to be protected is provided with a Hertzian wave transmitter, capable of transmitting vibrations to a distance through the intervening media. An alarm system actuates this transmitter when an attempt is made to enter the vault. Then a Hertzian wave receiver placed at the alarm station responds to the waves or vibrations produced by the transmitter and actuates a signal device.

606,407. Dynamo-electric Machine. Robert S. Dobbie, Jersey City, N. J. Application filed June 6, 1892.

An outside switch or series of contact points is so arranged that a dynamo having two or more pairs of pole-pieces can be made bipolar or multipolar at will.

606,449. Telegraph Instrument. James L. Cutler, Cincinnati, Ohio. Application filed October 18, 1897.

A magnet comprising a core, a coil wound thereon and a soft-iron bar connected at its central part to one end of the core and having its ends bent to form arms extending along opposite sides of the coil with their extremities adjacent to the free end of the core, in combination with an armature lever located in the field of the magnet pivoted on one of the arms and extending in line with the free ends of the arms and core.



NO. 606,560.

606,450. Railway Signaling System. Charles H. Davis, New York, N. Y. Application filed December 29, 1897.

One claim describes a single series of signal devices, each having a safety signal and a danger signal, means for actuating the signals to cause them to be displayed, a locking device engaging with this actuating device and circuit-closing devices controlled by it also, an electromagnet controlling the locking device and circuit connections.

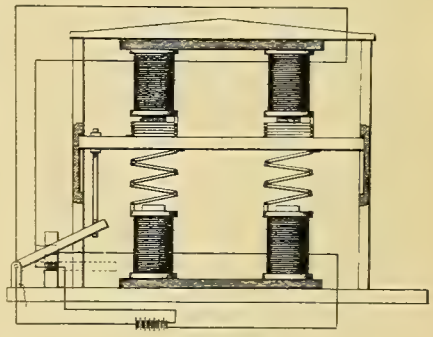
606,526. Secondary Voltaic Battery. Ludwig Epstein, London, England. Application filed December 28, 1895. Patented in France December 21, 1894; in England December 21, 1895; in Belgium December 21, 1895; in Canada January 15, 1896, and in Italy January 23, 1896.

In a secondary voltaic cell having negative plates in which lead oxide is the active material and positive plates coated with amalgam of mercury and zinc, troughs in which the positive plates rest and in which the mercury is placed, and casings for the negative plates formed of porous non-conducting material inclosed between walls which surround the lower part of the plate, the walls having perforations except in their lower portions.

606,549. Portable Electric Drill. Ernest Holmes, London, England. Application filed November 18, 1897. Patented in England June 26, 1896.

A portable electromagnetic drill is described.

606,560. Regulation of Rotary-transformer Direct-current Electromotive Force. Benjamin G. Lamme, Pittsburg, Pa. Application filed February 10, 1898.



NO. 606,605.

The combination with a stationary transformer having means for varying the electromotive force supplied by its secondary, of a rotary transformer receiving current from the transformer secondary, one or more choke-coils, means for connecting the same in the secondary circuit and means for varying the field-magnet excitation of the rotary transformer, whereby a wide variation of potential at the direct-current terminals may be secured.

606,562. Push-button. Frederick J. List, Chelsea, Mass. Application filed November 5, 1897.

A circuit-closer consisting of an escutcheon provided on its inner face with a chamber and a cross-bar forming a contact-point, a push-button extending through the escutcheon and having its inner end broadened or formed into a disk, the wire forming the other electrode being coiled around and upon the disk.

606,589. System of Electrical Distribution. Charles F. Scott and Benjamin G. Lamme, Pittsburg, Pa. Application filed January 28, 1897.

A system of electrical distribution comprising an alternating-current-supply circuit, one or more direct-current motors, a rotary transformer taking alternating current from the supply-circuit and supplying direct current to the motor or motors and means for varying the alternating-current electromotive force supplied to the rotary transformer and thereby varying the direct-current electromotive force and consequently the speed of the motors.

606,605. Electric Motor. Jonathan G. Truman, Lemon City, Fla. Application filed January 10, 1894.

The third claim is given: In an electric magnetic motor the combination with vibratory armature, electromagnets positioned on opposite sides of the same, a series of plates, the plates of each series being alternately connected, the opposite end plates being attached to the armature and to the magnets, a switch operated by the vibratory armature to alternately make and break circuits, and an electric generator or battery.

606,620. System for Electrical Communication. Alexander T. Brown, Syracuse, N. Y. Application filed April 9, 1896.

A party-line system comprising a metallic circuit, one or more stations having responsive devices in the metallic circuit, two or more stations each having a ground-tap and a responsive device therein, a source of electrical energy with an optional ground-tap, placeable in that branch of the metallic circuit which connects the junction points of the first and last ground taps and includes the responsive device of the station or stations first specified, and telephonic devices at each station placeable in the metallic circuit.

606,630. Alternating-current Motor-meter. Julius A. Möllinger and Karl Kurda, Nuremberg, Germany. Application filed December 27, 1897.

This meter has a shunt-field consisting of two inductive-resistance coils placed in series with the coil of a choking device, the core or cores of the shunt-field magnet being constructed of thick sheet-iron, cast-iron plate, steel-plate or solid iron, and the core of the choking device of thin subdvided well-isolated sheet-iron.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, JULY 16, 1898. No. 3

Bending Heavy Rails.

With the introduction of electricity upon street railways, especially in the larger cities, and the consequent improvement in road-bed construction made necessary by the heavier equipment used and the higher speeds attained, the adoption of heavier rails has become necessary, and the difficulty of making curves for street corners has correspondingly increased. On the old street railways, where comparatively light rails were used, curves were made with a plunger, which was a modification of a system borrowed from steam-railroad practice. This method was unsatisfactory, however, as it involved considerable expense and delay, and did not fully meet the requirements. It was impossible to obtain a true curve where these old methods were employed, as the bend in the rail was really a succession of irregular kinks produced by the force of the repeated thrusts administered by the plunger.

Modern street-railway practice demanded that immediate attention be given this matter, as it soon became evident that motor equipments were seriously affected by the jolting due to the irregularity in the curves over which they operated, and the multiplicity of curves in large street-railway system consequently made this subject an important feature in first cost, maintainance and operation. These considerations induced Mr. C. E. Moore, the master mechanic of the Chicago City Railway company, to undertake a series of experiments that resulted in the development of an entirely new system of bending rails and the building of a machine for this purpose. The apparatus and its use are illustrated in the accompanying cuts. The picture on this page (Fig. 1) is a half-tone reproduction of a photograph of the machine in operation in the shops of the railway company on Dearborn street, between Twentieth and Twenty-first streets. The photograph was taken while a seven-inch 90-pound rail was being passed through the machine. The line drawing (Fig. 2) on page 30 shows the details of construction of the machine and the foundation, the arrangement of the jack-shaft and gearing and the method of application of power.

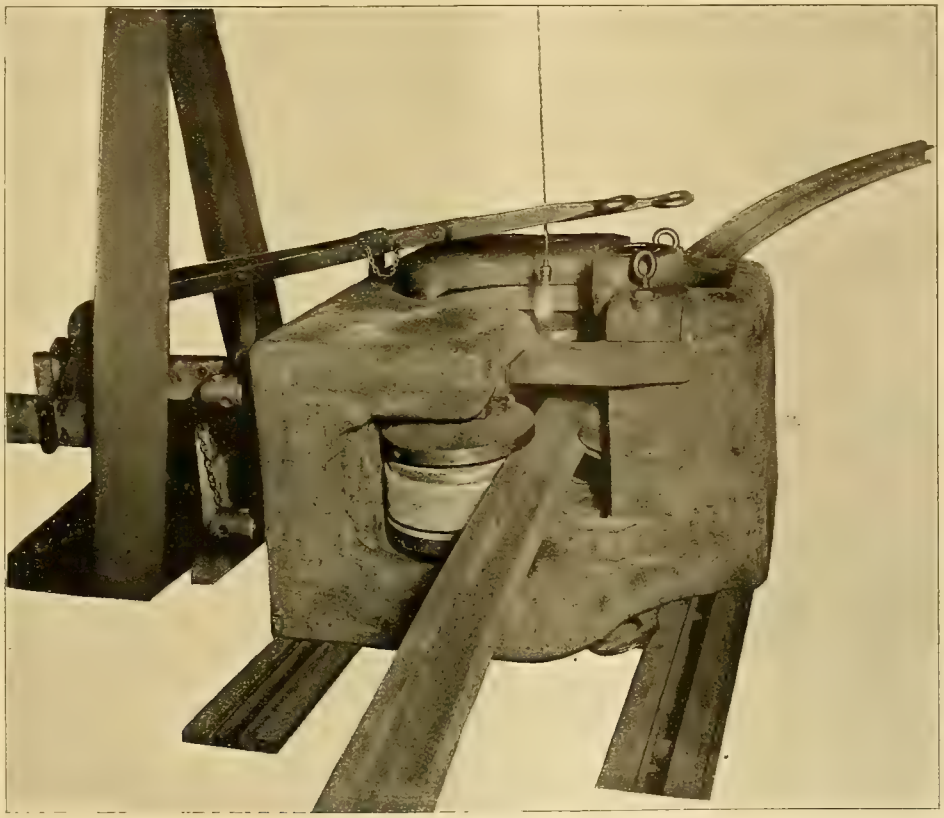


FIG. 1. BENDING HEAVY RAILS.

The machine itself comprises one casting weighing approximately four tons and consisting of a frame containing three rolls so arranged that a rail is bent in passing through. The machine is pivoted on a vertical driving shaft, and its position on the floor can be shifted when necessary. In turning out certain curves it was found that the rails would strike the supporting columns of the building if the machine remained stationary, and therefore it was deemed advisable to provide for swinging it on the vertical shaft. This will not interfere with the operation of the machine in any way, as there is only one driving roll and this is feathered on the vertical shaft. The upper bearing of this roll, which can be seen at the right in Fig. 1, is in a cap which is bolted to the frame of the machine. The other rolls are idlers. One is prominently shown in the cut and the other can be detected through the opening in the top of the machine.

In operation the rail passes between the driving roll and the idlers, the three being located so as to form an isosceles triangle. The two idle rolls have bearings in two jaws which are moved horizontally in guides with the frame. For the adjustment of each of the jaws there are two three-inch, square, threaded screws, each of which turns in a large brass nut which is a bushing through the frame casting. Any desired curve can be obtained by adjusting the position of these two idle rolls with reference to the driver or fixed roll. The shaft for each idle roll has only a half bearing, and can be easily removed by pushing the jaw to the inner end of the guide and removing a pin. When it is desired to change the rolls the nuts are removed and the cap lifted off and the entire mechanism is thus accessible. The rolls are made of cast iron and weigh about 300 pounds each. They are turned up to fit the outline of the rail. Three sizes are employed at present, the largest being for seven-inch 90-pound rails. It should be mentioned, however, that in building this machine provision was made for the future, so that if necessary 12-inch rails may be bent by merely substituting larger rolls and without changing the machine itself in any particular.

The foundation for the machine is substantially constructed of concrete and rails. The driving mechanism occupies a pit or basement under the machine, as shown in Fig. 2. It will be noticed that the vertical shaft on which the driving roll is fixed is driven by gearing. Power is conveyed by a shaft upon which there are three pulleys at the left, as indicated in the cut. The middle pulley is keyed to the shaft and the two outer pulleys run loose. Two belts run from the shop shafting, one straight and the other twisted, so that by the use of the belt shifters the machine can be run either forward or back. The small bevel gear shown in Fig. 2 at the end of the pulley shaft meshes with the gear on the vertical shaft, which reduces the speed to one-third. This arrangement is an important feature, as with the jaws fixed in one position the rail will pass through and be an arc of a true circle, but by adjusting the idlers and running the rail forward and back any desired curve can be obtained. A compound curve can be made by the substitution of another set of rolls.

The machine takes 12 horse power to operate it, and curves a 90-pound rail at the rate of 40 feet a minute. Formerly it required nine men four hours to bend one 90-pound rail, and the process was both tedious and laborious. The cost of bending curves has been reduced from 13 cents to one cent a foot. At the present time the Chicago City Railway company is engaged in construction work that includes 50 curves. To bend the rails for this job would require nine men 800 hours and would entail an expense of $1,200 for labor. The first time the bending machine was used it turned out 17 perfectly curved rails in eight hours, three men being employed at a cost of $4.

Since then plans have been perfected for the introduction of pneumatic hoists for unloading and handling the rails, which will not only reduce the cost of the process still further, but will greatly facilitate the work. When the rails are brought into the shop they will be lifted from the car and taken to the cutting machine, where they will be trimmed to the required length. They will then be conveyed to the bending machine, and after being given the desired curve they will be reloaded and transported to their destination. Those who have had experience in this class of work will appreciate the saving of labor and annoyance effected by the change.

Before the machine was put into operation there was considerable speculation as to whether the rails would be carried through unassisted, or whether they would have to be forced through. In practice it was found that no assistance would be required, the power exerted by the driving roll being sufficient. It was noticed upon examining the rolls after the first rail was passed through that the name of the railmaker had been impressed upon the rolls. This will furnish some idea of the force employed in the operation. Mr. Moore is contemplating a series of tests to determine the strains to which the rolls are subjected during the process.

Flywheel Explosion.

The general rule that proof of an accident is not of itself proof of negligence, admits of some exceptions, but the Third Appellate Division of the Supreme Court of New York holds in the recent case of Piehl against the Albany Railway company that the rule and none of the exceptions to it applies to the bursting of a flywheel. In this case a fragment of the wheel killed a person across the street. The wheel had been purchased from the manufacturers and had been used in generating electricity for the operation of street cars for two years before the explosion.

The court, in explaining its ruling, said that such are the limitations upon human foresight that every reasonable care does not always prevent accidents, and that such is the nature of steam and electricity and of the engines by or upon which they operate, that, when such an explosion as this occurs, its experience, or even expert experience, is not sufficiently uniform to justify the presumption that negligence is the cause. Nor does the court consider that the evidence tended to show that the operation of the engine and fly-wheel in question alone, or in connection with all the other operations within the power house, constituted a nuisance, though it admits that it was quite possible that the noise of the machinery, the vibrations they caused and the occasional flashing of electricity may have been an annoyance to the next-door neighbors. Neither does it think that the noise, vibrations and flashing tended to show that the flywheel was in danger of bursting. It also insists that it must be made to appear to a reasonable probability that the presence of an electrical engineer would have saved the flywheel, before it could say that this injury came about through his absence.

There have been several accidents of this kind in different parts of the country and much interest will therefore attach to the opinion of the New York tribunal, as its decision will doubtless be accepted as authoritative in disposing of claims for damages where the conditions are the same as in the Albany case.

International Electric Railway.

The Niagara Falls Park and River Railway company is now running cars across the upper new steel arch bridge at Niagara Falls. This is the first international electric railway between the United States and the Dominion of Canada. The Niagara Falls Park and River Railway company controls and operates the trolley line along the Niagara River bank on the Canadian side. By establishing a connection with the New York state side the management of the road shows that it is enterprising and awake to the necessities of the Niagara situation. The great crowds of people who visit the Falls alight from their trains on the New York state side of the river, and usually proceed to Prospect Park, from which they diverge in all directions. The new connection of the Niagara Falls Park and River railway brings cars close to the gates of Prospect Park, where they will be able to load thousands of passengers for the trip along the Canadian side, thus diverting considerable travel from the channels on the New York state side of the river.

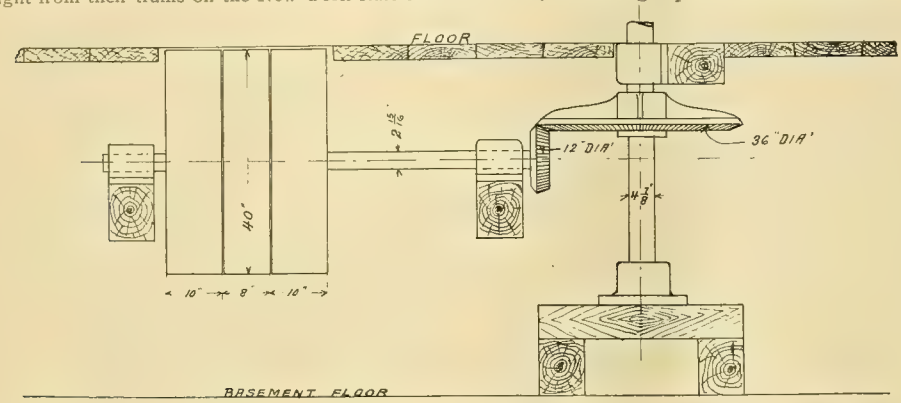


FIG. 2. BENDING HEAVY RAILS.

The line across the bridge was opened on the evening of Thursday, June 30th. The first car to make the crossing was No. 19, in charge of Conductor John Barker and Motorman R. W. Murray. It was about 7 p. m. when the car ran through the switch from the main line onto the bridge track. It was boarded by J. C. Rothery, superintendent of the road, Manager Phillips of the road, S. J. Smythe, president of the bridge company, J. M. Bostwick, treasurer of the same company, R. S. Buck, engineer, Superintendent Dill and John Houp, foreman. The press was also represented. The track was found to be especially smooth and well laid, while the view from the car, as it sped across the arch, was all that could be desired. Passing in full view of the great cataract, the scene was unexcelled, while the view down the gorge was equally delightful. It was pronounced unrivaled by any trolley trip at Niagara.

The car was put into regular service that evening, and has since been making regular trips, its patronage being all that could be desired. The line will be double-tracked, but only one track has been laid so far, the one rail of the second being in position. However, it will not be long before both tracks are in use. At present a stranger's ticket across the bridge entitles him to ride on the cars, but citizens have to pay an extra five cents. This is because the bridge toll to residents is slightly lower than to strangers. It is believed that the opening of the bridge line is another link in the prospective belt line around the gorge from the Falls to Lewiston.

INTERNATIONAL ELECTRIC RAILWAY.

Proposed Standard Diagrams of Electrical Apparatus.[1]

By Prof. Andrew Jamieson.

You were kind enough to send me a copy of the Western Electrician and of Electricity, both of America, containing reports of a committee of the Chicago Electrical association for February, 1898, wherein it was stated:

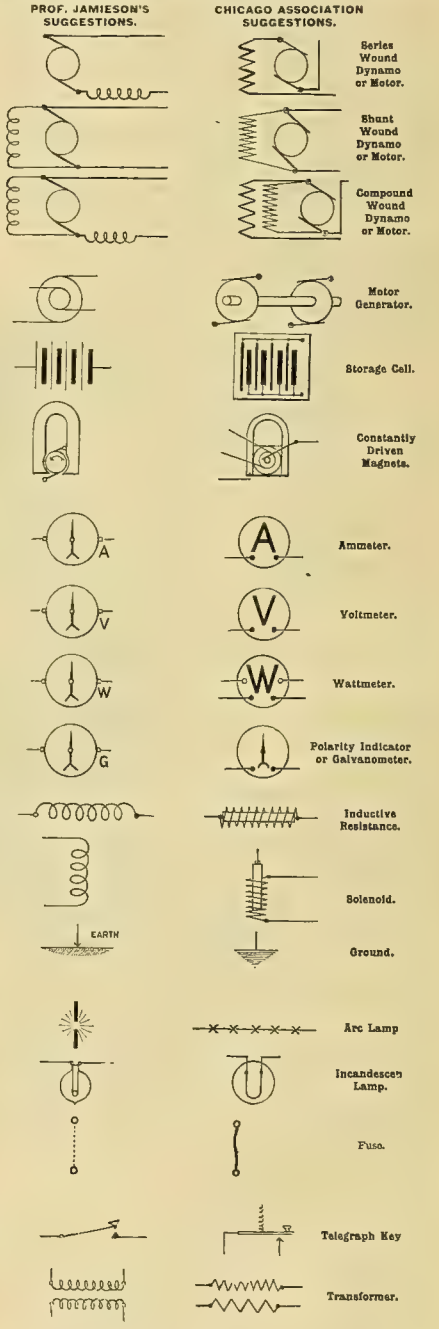
"The time has arrived when the diagrammatic illustration of electrical apparatus should be reduced to an art. A uniform code should be established containing a diagram for each piece of apparatus, each diagram being at once simple and, so far as possible, suggestive of the particular piece of apparatus which it is designed to represent."

"A decided improvement has been made in this direction during the last few years, yet at the present time the system is far from perfect. Its development has suffered through a lack of unity among the various makers of these diagrams."

"The electrical divisions in the Patent Office have done more toward the development of this art than any other one agency. Often in a drawing accompanying an application for a patent, when a circle was used to represent a battery, and another circle exactly like it to represent a dynamo, and still another, differing in no respect, representing the ground, the drawing was necessarily confusing, and was followed with difficulty, if at all. In such cases it has not been infrequent for the Patent Office to suggest to the inventor or his attorney that he submit a new drawing, using a certain adopted form or diagram to represent his battery and another to represent his dynamo, and so on. In this way, and with the well-directed efforts of a number of patent attorneys, a great improvement has been made. These diagrams are to further assist in this direction."

Then follow some 55 diagrams of electrical apparatus with an explanation thereof. I have looked over these diagrams, and have read the remarks as published in the American papers, and herewith offer some suggestions for improvement in the proposed figures. I do so from having taken a special interest in this matter for a number of years, and from the fact that I read a paper in May, 1885, before the British Society of Telegraph Engineers on "Electrical Definitions, Nomenclature and Notation," and when we had the benefit of M. Hospitalier's discussion thereon.[2]

Since then I have frequently advocated an international uniform system of definitions, symbols and electrical diagrams, and have from year to year published in "Munro and Jamieson's Pocket Book" a few of the simpler figures. Consequently I have much pleasure in complimenting the energy and ability shown by the Chicago Electrical association in going one step farther than any other similar association has hitherto done. I have, therefore, taken the liberty of cutting out a few of their figures and pasting alongside thereof what appears to me to be improvements thereon.



PROPOSED STANDARD DIAGRAMS OF ELECTRICAL APPARATUS.

In the first place, their figures for series, shunt and compound-wound dynamos or motors have the objections of representing the field coils by zigzag lines, which have hitherto been universally adopted to represent non-inductive resistances, whereas the field coils of such dynamos are anything but non-inductive. Further, in the case of the series and compound-wound dynamos or motors, their diagrams are unnecessarily complicated by drawing the leads from each brush with two right angles, whereas in the diagrams usually adopted by electricians, and shown in my figures to the left, the leads come straight away from the brushes.

1. From the Electrical Review, London.

2. For M. Hospitalier's views, see "Communication faite à la Société Internationale des Electriciens, le Novembre, 1884," and for my paper see Journal of Society of Telegraph Engineers, p. 297, 1885, vol. xv.

Their figure for a motor generator is greatly simplified, and conveys the full meaning desired to be imparted by that which I have shown on the left.

With regard to the storage cell, I think all that is necessary to distinguish it from a primary battery are the letters S and B respectively, placed underneath the usually accepted sign of long thin and short thick parallel lines.

Granted that there are cases where it might be necessary to distinguish between the hand generators at subscribers' stations and the power generators at a central office, I don't see the slightest necessity of complicating the figure of a constantly driven magneto by inserting lines to represent the belt when a mere arrow on the armature spindle would be sufficient, as shown by my figure to the left of theirs.

With regard to ammeters, voltmeters, wattmeters

ORNAMENTAL POSTS FOR STREET LAMPS.

and polarity indicators, or galvanometers, I think you will agree with me that those shown on the left are much simpler, neater, and sufficiently distinguished from each other by the letters A, V, W and G.

In the representations of an inductive resistance and a solenoid, it will be noticed that the iron core is omitted in my suggestion as shown on the left. Surely, the fact of a wire being coiled in a spiral form is sufficient to convey the idea of the presence of a certain amount of self-induction.

With respect to the next diagram, we do not in this country speak or write of a connection to the "ground," but to the earth, and what could be more in harmony with the well-known and long-accepted telegraph symbol as shown on the left?

There can be no objection to a number of crosses, as shown, to represent arc lamps in series, but for the indication of a single lamp I should recommend the diagram on the left.

My next three diagrams, as representing an incandescent lamp, a fuse and a telegraph key are also more in conformity with practice than the corresponding ones indicated by the Chicago Congress.

Finally, we have again to find fault with their use of the well-known symbol for non-inductive resistances in the representation of a transformer.

Other objections might have been found, but these are sufficient to show the diversity between American, British and Continental practice, and hence the need for coming to an early state of uniformity.

A Great Carbide Plant.

The Union Carbide company of Chicago is arranging to greatly enlarge its plant at Sault Ste. Marie for the production of calcium carbide. The plant at Niagara Falls will be continued, but that at Appleton, Wis., will, it is said, be discontinued. As is well known, an intense heat is necessary in the furnaces of a carbide plant to flux the materials of which the carbide is composed. This heat is best secured by the passage of currents of electricity through great carbon resistances embedded in the furnaces. Twenty dynamos will be used in the plant at the Soo, and they have been purchased from the Walker company. These machines are single-phase, low-frequency alternators of 500 kilowatts each, delivering 2,500 amperes at 200 volts. They will be excited by five direct-current machines of 100 horse power each, and the large order also includes the switchboard. The dynamos will be water-driven, the plant being located at the falls of the Soo for that purpose. It is said that the capacity of the plant, which will be the largest in the world for producing carbide, will be 100 tons a day. The buildings will be large enough to accommodate double the initial capacity of generators and furnaces. The order for the electrical machinery is one of the largest ever placed for alternating-current generators.

Ornamental Post for Street Lamps.

The accompanying cut shows an ornamental post for street lighting manufactured by Joseph P. Cullen of Buffalo. It is a modification of the double-lamp Fifth avenue post, which has proved so popular since its introduction in New York several years ago. Mr. Cullen's post is substantial in construction as well as attractive in design.

Dr. Cornelius Herz.

The remarkable career of Dr. Cornelius Herz, the Franco-American scientist, promoter and politician, came to an end by death in Bournemouth, England, on July 6th. Dr. Herz was born in Besançon, France, on September 3, 1845, but his parents brought him to the United States when he was four year old, and he always claimed American citizenship. He grew to young manhood in the state and city of New York, graduating from the College of the City of New York with honors. He continued to pursue his studies abroad, and he attended lectures in the universities of Heidelberg, Munich, Vienna and Paris. At the last-mentioned institution he took the degrees of bachelor of science and bachelor of arts. He entered the School of Medicine of Paris and became a doctor of medicine, serving as a surgeon with the French army in the Franco-Prussian war.

In 1871 Dr. Herz returned to his adopted country and came to Chicago, where his parents resided. He was here at the time of the great fire, and during the reconstruction period that immediately followed the city authorities availed themselves of his services in remodeling the Health Department. Afterward he was connected with Mount Sinai Hospital in New York. He next transferred the scene of his activities to San Francisco, where he practiced medicine. Here he seems to have first entered upon his extraordinary series of operations as an electrical promoter, although it is said that he had exhibited a fondness for electrical research from an early age. He secured control of the Jablochkoff arc-lamp patents for the Pacific coast states, and a company was formed to introduce the new form of illumination. This enterprise was not successful; but Dr. Herz is credited by a recent biographer

DR. CORNELIUS HERZ.

with being the founder of the California Electrical Works.

It was in France, however, that Cornelius Herz principally distinguished himself. He returned to that country and became engaged in electrical undertakings of great magnitude. He was a man of great talent and force of character and appeared to have no trouble in securing all the capital necessary for his projects. He organized companies, established journals, fostered expositions, sent out scientific expeditions and superintended laboratory research. His period of greatness was between 1878 and 1892, and in this time he became one of the leading figures in the French republic—the friend and intimate of statesmen, scientists and financial magnates. He was a member of many scientific societies, received decorations and honors and accumulated wealth.

Only a partial list of the achievements of this remarkable man can be attempted here. Dr. Herz was the chief promoter of the first electrical exposition, that held in Paris in 1881. He founded and edited La Lumière Electrique and the Journal d'Electricité. In conjunction with the Rothschilds and other banking houses he established electric-light and telephone companies in many cities of France and other European countries. He built a large factory to supply electrical apparatus of all kinds. He is credited with being the originator and principal founder of the great scheme for interconnecting all the 36,000 communes in France with a network of telegraph and telephone wires. He collaborated with Marcel Deprez in experiments in electrical transmission and distribution and was one of the first to recognize the practical importance of electricity as an agent for the transmission of power. He was interested in all forms of electrical application—lighting, both arc and incandescent, motors, telegraphy and telephony, delicate measuring instruments and experimental apparatus. In recognition of his [illegible] representative of the [illegible] Electrical Exposition, [illegible] Holy Order of St. Michael [illegible] of the Order of St. Maurice [illegible] commander of the Legion [illegible] During his subsequent trouble [illegible] was stricken from the roll of the [illegible]

These troubles arose in 1892 and [illegible] closing years of Herz's life. They grew out of the Panama Canal scandal, in which, it was charged, Dr. Herz was implicated. He was charged with being a blackmailer and extortioner and he was forced to seek refuge in England. His health gave way; he had to defend himself from the vigorous efforts that were made to [illegible] him; his estates in France were confiscated [illegible] to pay costs of litigation, and he died a disappointed and broken-down man. His friends maintain that he was the victim of the persecution of the French government; that he was the scapegoat offered to appease the French people, who demanded a victim of the first rank to expatiate for the corruption in official circles that was revealed by the exposure of the affairs of the Panama Canal company; and they point out that the French government could not make out its case in the English courts. At any rate, the last years of Dr. Herz formed a sad contrast to the brilliant successes of his mid-career. Out of these troubles grew a claim for $5,000,000 indemnity against the French government which Dr. Herz, claiming to be an American citizen, asked the American government to collect. This claim was pending at the time of Dr. Herz's death.

Dr. Herz leaves a widow, who is an American; one son, Ralph C. Herz, who is a student at Cambridge, and five daughters. A brother, Joseph Herz, is engaged in business in Chicago, and there is a sister living in Lakewood, N. J., and another in London.

Attractions for Street Railways at Niagara Falls.

The Niagara Falls and Lewiston railway, better known perhaps as the "Great Gorge Route," has rather remarkable facilities for entertaining the passengers over that line who desire to add some unusual feature to their trip to the Falls. If they find the ride through the gorge on the electric cars monotonous, something which is not at all likely to occur, or if they feel like getting out on the wild waves of the Rapids, provision has been made to accommodate them.

Some months ago Mr. Evans of the Youngstown and Lewiston road conceived the possibility of establishing a line of canoes in the gorge, to run from the Devil's Hole to Lewiston, the Devil's Hole being one of the popular stations on the Gorge road. He secured experienced Indian chiefs from the Sault Ste. Marie, and in their canoes the wild waters of the lower portion of the gorge were safely traversed. At present Chief Flying Cloud and Chief Cherry are engaged in shooting the Rapids in canoes.

An Electric-light Plant on Wheels.

The illustration shows the enterprise of a showman who is making the circuit of the central states with an opera troupe. In order to get the proper effects in stage lighting he has installed in a wagon a dynamo, driven by a gasoline engine, with all the necessary adjuncts of a small electric-lighting plant. As may well be supposed, this outfit attracts a great

AN ELECTRIC-LIGHT PLANT ON WHEELS.

deal of attention in towns in which the show stops, especially where the towns have no lighting plants of their own.

The plant forms one of the best advertising features of the show and has more than paid for itself in increased receipts, to say nothing of the better light produced by this means. The dynamo was built by the Hobart Electric Manufacturing company of Troy, O., and during the two years that it has been in service has had no repairs made on it. It has been carted around over rough roads in all kinds of weather, but shows no ill effects.

The show was in the northeastern part of Indiana late in June, and the proprietor wrote from Nottingham that "business is extra" and that he had fine lights.

Electric Power in Meat-dressing Establishments.

The great packing interests of this country have always been very conservative in their methods of business. The perishable nature of the products they handle, together with their great value, makes it necessary that the operation of such plants shall be absolutely without interruption. Part of the apparatus, such as pumps connected with the refrigerating system, must operate continuously 24 hours a day every day in the year.

The successful applications of electric power which have been made in various difficult fields have at last emboldened those interested in the packing business to look to that means of operation as the most to be desired. The first notable installations of the kind are now in successful operation at the large establishments of Swift & Co. and Nelson Morris & Co. in St. Joseph, Mo. The plants were designed and installed by the Westinghouse Electric and Manufacturing company, which has always been a pioneer in exploiting new fields of electrical application.

Both plants have been in full operation since April 1st, and in the opinion of engineering experts who have been accustomed to the old methods of shaft, pipe and rope transmission for the work, electric power is not only more convenient in operation, but is far more reliable and freer from interruptions than any of the old methods. This has, however, been the experience with electricity in every new field of usefulness, and the old prejudices as to its fancied complexity are rapidly disappearing as one instance after another is reported where the electrical apparatus is the most reliable part of all the machinery of a plant.

The packing-house of Swift & Co. at St. Joseph (Fig. 1) is known as No. 6 of those recently equipped. It is the only one in which electric power was introduced at the outset, and it was started with less delay and fewer accidents than any of the others. There have been no shut-downs since the plant was started, although it has been constantly running at its full capacity. The power plant consists of two cross-compound Filer & Stowell Corliss engines, rated at 250 and 350 horse power respectively. These are connected by rope transmission to two Westinghouse two-phase alternators, producing current at 7,200 alternations and 220 volts. The smaller is of 180 kilowatts capacity and the larger of 250 kilowatts. These generators operate in parallel to carry the day load, but the smaller alone is of sufficient capacity to carry the all-night load.

Fig. 2 shows a general view in the power house, looking toward the switchboard. The latter consists of 13 panels. The two panels on the extreme left are the generator and exciting panels for the 250-kilowatt generator. The next two serve the same purpose for the 180-kilowatt generator. These panels, besides containing the necessary switches and circuit-breakers, are equipped with ammeters for both phases, and with Westinghouse "Niagara type" indicating wattmeters showing the amount of power delivered at any time. When the generators are run in parallel these instruments indicate the load on each machine. This is a very important feature, as ammeters alone for this purpose may be misleading. The "Niagara type" of Shallenberger alternating-current instruments has as the moving element a simple disk of aluminum, which is acted upon by currents in coils near the disk. At the circumference of the disk there is a cylindrical scale, which moves in front of a fixed pointer. In this manner the whole circumference is utilized and a long scale with large divisions is secured. The instruments are neat in appearance and are claimed to be remarkably accurate in their indications. Panel No. 5 contains a continuously indicating ground detector, together with ammeters and integrating wattmeters for measuring the entire output of the station.

Each of the eight departments of the packing-house is in a separate building, and each building is fed by its own feeder panel. The feeder panels are equipped with ammeters and also with integrating wattmeters, so that an accurate system of charging each department with the amount of power consumed is maintained. This, in itself, in view of the close margins of modern business and the prevailing tendency toward analysis of costs, is a striking advantage given by electric power over other forms of transmision.

FIG. 1. ELECTRIC POWER IN MEAT-DRESSING ESTABLISHMENTS. -SWIFT & CO.'S PACKING-HOUSE AT ST. JOSEPH, MO.

In the eight departments of the establishment there are in all 78 motors in use, varying in capacity from one to 40 horse power. Seventy-two of these are the well-known Westinghouse type C motors, constructed with the Tesla polyphase induction patents as a basis. These motors have no moving contacts or sliding resistances, require hardly any attention and are efficient and durable. Many of the motors in this plant are inverted and bolted to the ceiling, where they are entirely out of the way. In places where there is a great deal of moisture or steam, the motors are enclosed in a wooden box coated with pitch to exclude moisture. Hand-holes are constructed on the sides of these boxes to give ready access to the bearings. The machines are so little in evidence that a casual observer will go through almost the entire plant without seeing a motor.

There are in the plant nine freight elevators, operated by No. 3 type C motors. These elevators have a capacity of 2,500 pounds each and travel about 150 feet per minute. The driving mechanism of one is shown in Fig. 3. There is also a live-hog elevator for taking hogs to the first floor of the killing-house. It is operated by a No. 4 crane motor, and consists of two balanced cages, which will carry about 50 hogs per trip. An entire day's killing of from 2,500 to 3,000 hogs can be elevated 90 feet high in about five hours. At all other packing-houses the hogs are driven up a long inclined chute, and many are strained or overheated, thus spoiling the meat. This method of elevating live hogs to the killing floor is an innovation in packing-house work, and will command much attention.

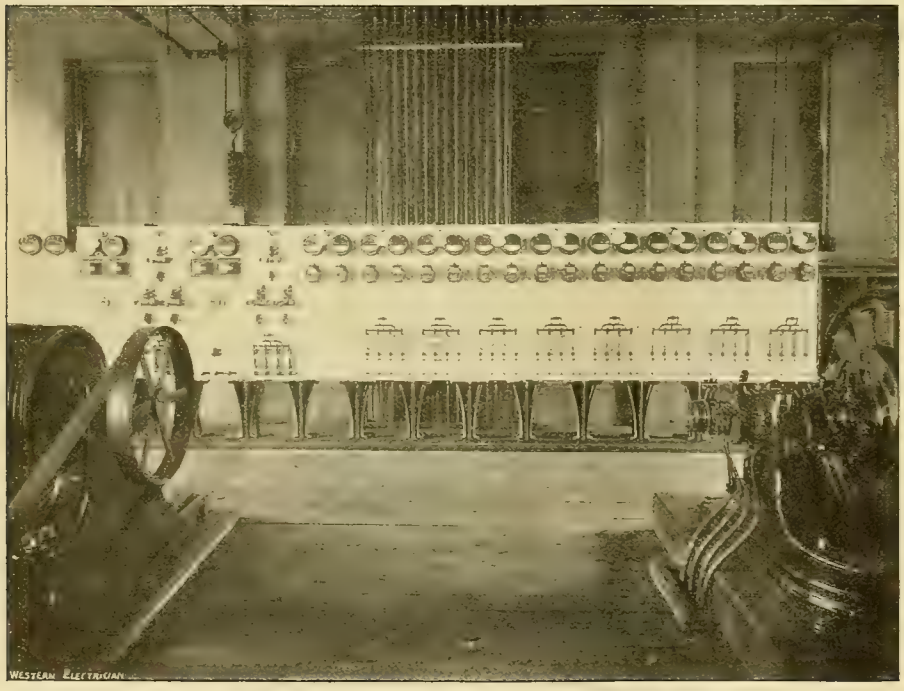


FIG. 2. ELECTRIC POWER IN MEAT DRESSING ESTABLISHMENTS.—GENERATORS AND SWITCHBOARD.

As meat freezes at about 39° Fahrenheit, the system of refrigeration adopted in most packing houses is that known as the brine system, in preference to "direct cooling," which can be made to give a temperature several degrees below zero. The former is the system used at the establishment of Swift & Co. To circulate the brine, two Gould triplex pumps are operated by two 40 horse power Westinghouse constant-torque motors (Fig. 4). The brine is circulated at a temperature of about 9° Fahrenheit, and the coolers are kept at a temperature of about 36° Fahrenheit. The amount of refrigeration necessary varies with the weather and with the amount of warm meat in the coolers. The pumps are designed to keep a constant pressure of brine in the service pipes. When more cold is required, a valve is opened in the cooling chamber to increase the flow of brine. This causes a momentary reduction of pressure in the pipe, which allows the motor to speed up, bringing up the pressure to what it was before. There are also two pumps operated by 20 horse power constant-torque motors (Fig. 5) for supplying water to the plant, and in addition a hot-water house pump operated by a 7½ horse power constant-torque motor (Fig. 6). The service required of this latter pump is very exacting. At times almost no water is required, and the pump runs very slowly. In a few seconds afterward it may be called upon for delivery up to its maximum capacity, or over. The motor quickly speeds up to supply the increased demand, and the extreme variation of pressure in the pipe is not over 10 per cent.

For lighting the plant 200-volt lamps are used throughout, and these are run from the same feeders which supply the motors.

There are two systems commonly in use for the application of electricity to shop power. One is that in which large motors are coupled to shafts which run several machines; in the other system each machine is separately driven by a motor of suitable size. The latter method is used at the plant described. No countershafting whatever is required, and when any machine has finished work for the day the motor is shut down. This greatly economizes the use of power.

The plant of Nelson Morris & Co. at St. Joseph is similar to that of Swift & Co., but in applying power to the different kinds of work the former firm has adopted the group system above mentioned, in which all machines in one room or department are belted to one system of countershafting and a motor of sufficient size installed to carry the maximum load. The motors have been grouped so that 28 machines, varying in size from five to 40 horse power, are sufficient to operate the plant. The capacity of the two plants is about the same. The advantage of the group system is lower first cost of motors and less wiring, with the motors running at a load giving a somewhat better efficiency. But this is at the expense of a considerable unproductive load of countershafting, which must be carried whether one or all of the machines connected to the particular motor are needed. The cost of attendance is about the same in both cases. Westinghouse type C motors require no more attention than ordinary countershafting. The motors are provided with self-oiling bearings, and often run from four to six months with no attention whatever. Time and careful records will tell which is the more economical of the two methods, but tests made in May at St. Joseph, as compared with tests made at other packing houses using the old methods of transmission and having the same output, indicate that the amount of steam required when the electrical system is used is only 35 per cent. of that required under the old methods.

American Institute of Electrical Engineers.

At the meeting of the executive committee of the American Institute of Electrical Engineers on June 24th C. O. Mailloux of New York was elected a vice-president of the Institute, to fill the vacancy caused by the previous election of Dr. A. E. Kennelly to the presidency. Robert N. Baylis was also appointed a member of the board of examiners, succeeding the late Dr. Charles E. Emery.

The following-named associate members were elected: Walter Cummings Allen, Washington, D. C.; Albert H. Armstrong, Schenectady, N. Y.; George A. Damon, Chicago, Ill.; Frank H. Dexter, Ithaca, N. Y.; P. M. Downing, Blue Lakes City, Cal.; Joseph Lyons, Washington, D. C. The following-named associate members were transferred to membership: Alfred A. Thresher, Dayton, Ohio; William B. Jackson, West New Brighton, N. Y.; Paul M. Lincoln, Niagara Falls, N. Y.; Thorburn Reid, New York; Philip Green Gossler, Montreal, Que.; Theodore E. Theberath, San Francisco, Cal.; Frederick M. Pedersen, New York; William K. Dunlap, Niagara Falls, N. Y.

J. H. Fisher, formerly secretary of the Southern California Power company, has been elected secretary and general manager of the Redlands Street Railway company, a controlling interest in the company having been recently purchased by his father, Henry Fisher. Several important improvements are contemplated, and it is rumored that the road will be equipped for electrical operation.

Infringement of Patent on Cut-out for Electric Motors.

In the United States Circuit Court for the Eastern District of Wisconsin Judge Seaman has determined that the American Rheostat company has been infringing the patent No. 565,867, granted on August 11, 1896, to Ernest P. Warner for a "Cut-out for Electric Motors," now controlled by the Western Electric company of Chicago. The decision was given on final hearing of the case in equity, July 5th. The complainant was represented by Barton & Brown and Albert L. Lawrence, and the defendant's counsel included Winkler, Flanders, Smith, Bottum & Vilas. The opinion accompanying the decision is appended:

"The patent in suit is for a 'cut-out for electric

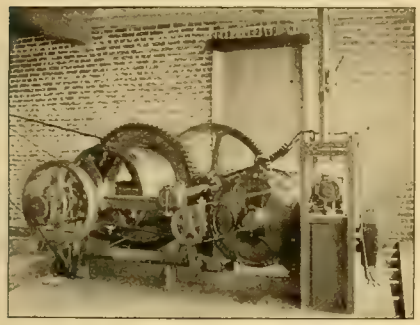


FIG. 3. ELECTRIC POWER IN MEAT-DRESSING ESTABLISHMENTS.—ELECTRIC FREIGHT ELEVATOR

motors,' containing four combination claims, all of which are alleged to be infringed by the defendant's device. Infringement is clearly established unless the feature by which 'the switch is covered, concealed or separated and made independent of the contact arm' constitutes an essential element of the patent combination, or, as stated on behalf of the complainant, 'the gist of Warner's invention.' Therefore as that feature is omitted by the defendant, the inquiry is twofold—(1) whether that is an essential element, and (2) whether there is patentable novelty in the invention, discarding such feature.

"1. he contention for the defendant is, in effect, that the definition in claims one, two and three of 'the combination with a rheostat included in the armature circuit and provided with a contact arm adapted to be moved to cut in and out resistance' of a switch in the same circuit 'independent of said contact arm,' etc., refers solely to the feature of the covering which renders the switch inaccessible to the operator, and that such meaning appears from the descriptions in the specifications of the switch that it is 'inaccessible directly and can only be closed by moving the contact arm of the rheostat to cut in the starting resistance, the switch being closed by that operation;' and the further specification that 'the magnet e, contact fingers d and d'

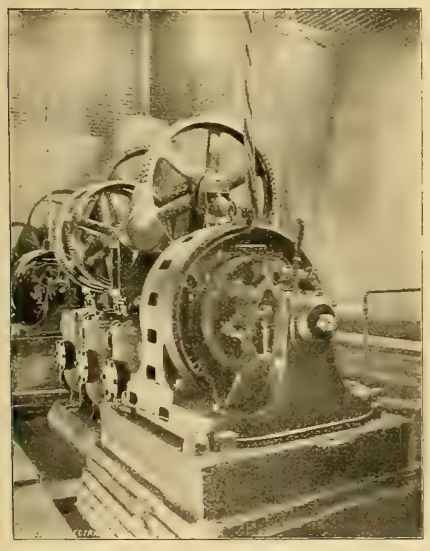


FIG. 4. ELECTRIC POWER IN MEAT DRESSING ESTABLISHMENTS —BRINE CIRCULATING PUMPS DRIVEN BY 40 HORSE POWER MOTORS.

are enclosed in a casing so as to be inaccessible readily to the attendant, so that the only way of closing the switch is by moving the contact arm to cut in the starting resistance.' If this element of independence named in the claims were clearly applicable to the inaccessibility mentioned in the specification, and especially if it can be given no other application, there would be force in the contention. But I am satisfied that the terms 'independent of said contact arm' were neither so intended nor so applicable; that they should not be paraphrased, as interpreted by Mr. Bates, to read 'means for making inaccessible the switch arm of the device,' or any equivalent terms, and that, whatever importance they may have in determining the claims, the view stated by Mr. Warner is more reasonable, namely, 'the contact arm of the rheostat, with its series of segments or contacts, or switch, the switch in the armature circuit, which is held closed by a responsive device, adapted to release it whenever current through the motor ceases, is another switch. The meaning conveyed by the words mentioned is, therefore, that while the two switches are in the same circuit and in series with each other they are allowed a certain independence of action. A cessation of current does not cause a movement of the rheostat arm, but does cause a movement of the other switch arm. The placing of a casing over a portion of the mechanism as described has no material effect upon the independence contemplated in the claim.'

"The casing is a mere matter of detail protecting against careless handling, but its omission would not interfere in the least with the normal operation of the mechanism, and it is not made an essential element of the combination, nor even shown in the drawings.

"2. The defendant's device is in accord with patents No. 555,503, to Gibbs, dated March 3, 1896, and No. 578,707, to Bacon, dated March 16, 1897, under which a justification is asserted, but cannot be sustained, as the complainant's patent is issued upon an application filed March 5, 1895, and antedates the application in both patents so referred to The fact that the Warner application was forfeited for inadvertence and subsequently reinstated cannot affect this priority, and no issue of fact is raised upon the question of the actual priority of any invention in the device. The inquiry must be directed, therefore, to the issue of patentability, in view of the prior patents and the state of the art, and it involves difficulty, if not serious doubt, when consideration is given to the nice distinctions in the advance of electric art, and the purposes and realizations of the prior devices. It is apparent that Warner, Gibbs and Bacon were each seeking the same end in a controlling mechanism for electric motors which would save the armature from injury when the current is turned on and before the counter electromotive force is generated by rotation of the armature. In Warner's patent the object is stated 'to provide means for preventing the starting of a motor without first cutting in the starting resistance of the rheostat.' As better defined in the Gibbs patent, it is 'to avoid injury to the motor by an abrupt increase of current through the armature, or the sudden closing of the armature circuit, so as to allow the full current to pass through the armature before it has time to get under motion and generate a counter electromotive force.' The Bacon patent states that it is 'designed to control the flow of the electric current to a motor to prevent the premature passage of the full current through the armature thereof.' The elements which enter into the combination of each in working out the alleged invention are in my opinion substantially identical as above indicated; and if the combination is patentable, the Warner device owned by the complainant must prevail. The fact that the several elements are not novel cannot defeat the patent, if they cooperate in a new combination and produce novel results.

"For the defense of anticipation numerous patents are set up in the answer and introduced at the hearing, but other than the following are not referred to by the experts or relied upon in the argument on behalf of defendants; therefore consideration is required of six prior patents only:

Lozier's patent, No. 492,036, February 21, 1893.
Whittingham's patent, No. 396,791, January 29, 1889
Knight's patent, No. 338,084, March 16, 1886.
Rae's patent, No. 437,662, September 30, 1890.
Blades' patent, No. 453,032, May 21, 1891.
Blades' patent, No. 457,339, August 11, 1891.

"It is true that one and the other of these patents show elements of the combination in question, and that nearly all are present in at least the Lozier patent, for a purpose which seems closely identical; others, differing in their purpose, approach the mechanism of the complainant's device with similarity more marked than in Lozier's device. But the fact remains that neither shows the device as completed by Warner; that the Warner idea, if it entered into the minds of those inventors, was not carried out in a perfected device for the purpose. The testimony of the experts for defendant concedes imperfection in each of the prior devices to the extent that neither was operative for the Warner object without alteration and the substitution of elements not in the original device; and the exhibit models which the defendant produced and operated at the hearing as purporting to show the mechanism of four of these prior patents were thus changed—not surreptitiously, but openly—to indicate their adaptability to the same purpose, claiming that the change was of such trivial character in each case that it would readily and at once suggest itself to any ordinary mechanic seeking that purpose, and therefore involved no invention. It is manifest, however, that the purpose of the final invention was not realized in either of these devices, nor does it appear to have been contemplated in either, unless it be in that of Lozier, on which the stress of the argument for the defense centers; but that is at best a mere approach to the object thus assumed to have been in view, which could only be realized by the changes shown on behalf of the defendant, and was otherwise confessedly inoperative therefor. Upon the distinctions so conceded and appearing upon the face of the prior devices respectively, I am of the opinion that each is taken out of the range of anticipation [illegible] the successful combination [illegible] question, and that the patent [illegible] the view stated in Topliff v. Topliff, 145 U. S. 161, that 'it is not sufficient to constitute an anticipation that the device relied upon might, by modification, be made to accomplish the function performed by the patent in question, [illegible] signed by its maker, nor adapted, nor actually used, for the performance of such functions.' However narrow the interpretation must be upon the claims of this patent, I am satisfied that [illegible]

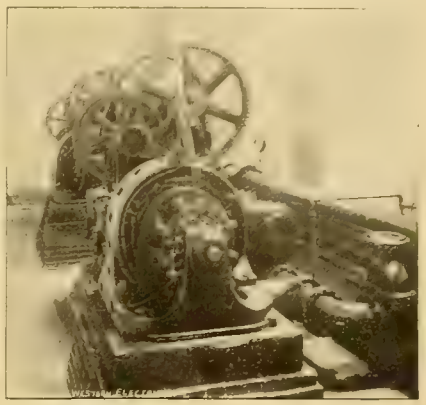


FIG. 5. ELECTRIC POWER IN MEAT DRESSING ESTABLISHMENTS — HOUSE PUMPS DRIVEN BY 20 HORSE POWER MOTORS.

and three are infringed by the defendants, and that decree must enter accordingly. So ordered."

Convention of Edison Association.

The convention of the Association of Edison Illuminating Companies will be held at Sault Ste. Marie on September 12th and 13th. It is proposed to make the trip to the Soo in the Northwest or NorthLand. The eastern members will take the boat at Buffalo and the western contingent will join the party at Detroit. It is expected that the party will reach the Soo on Sunday and will spend the day in sightseeing. The convention will begin on Monday morning and continue two days. This will give the members ample time to reach home without extending their absence over one week.

President Insull held a conference at New York last week with the representatives of the Edison companies in the East. All were enthusiastic over the prospect for this year's meeting, and it is now expected that there will be a large attendance.

San Francisco Statistics.

The annual report of the assessor of San Francisco shows that the Market Street Railway company is the largest taxpayer on the roll. The company is assessed for $1,178,300 on real estate, and

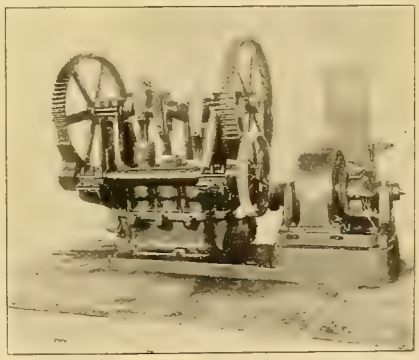


FIG. 6. ELECTRIC POWER IN MEAT-DRESSING ESTABLISHMENTS — HOT WATER PUMP.

$6,379,100 on personal property, making a total assessment of $7,557,400. The personal property of the California Street Cable Railroad company is assessed at $437,625; that of the Geary Street Railway company, $242,120; General Electric company, $106,250; Mutual Electric Light company, $147,134; Pacific Telephone and Telegraph company, $1,197,784; San Francisco Gas and Electric company, $2 540.540; Sutter Street Railroad company, $553,450; Union Iron Works, $228,190. The statistical report of the mechanical and manufacturing industries of the city shows that there are seven electric-light companies, employing 600 men and supplying 3,750 arc lights, 150,000 incandescent lights and 2,000 horse power in motors. These companies consumed 45,000 tons of coal in the year ended June 30, 1898, and the value of their product was $1,500,000. Seventeen factories for making electrical machinery and supplies are reported. They employ 250 hands, and the value of the manufactures is placed at $375,000.

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M. L. Godkin has been appointed eastern representative of the Western Electrician, succeeding R. J. Parvin, who is no longer connected with this paper. Mr. Godkin will have full charge of the paper's advertising and subscription business in the East, and will also act as eastern correspondent. His office will be at 148 Times building, New York, and courtesies shown him will be appreciated.

Professor Andrew Jamieson's suggestions for standard diagrams of electrical apparatus, as given on another page, are interesting when compared with the Chicago Electrical association's figures, but they are scarcely an improvement. We give them as a part of the discussion of a live subject, but do not consider that the Scotch professor (except possibly in the case of the motor-generator) has advanced sufficient reasons for the changes he suggests.

In Paris the telephone occupies a place in the formalities of social and official life that it has never attained in this country. When the news of La Bourgogne disaster reached Paris, according to the correspondent of the Sun, "President Faure telephoned the following message to the General Transatlantic company: 'I am grievously distressed by this terrible news. I share deeply in this disaster, which puts into mourning so many French-American families.'"

At present it looks as if the Allen law would be made a feature of the political campaign in Illinois this year. The Democratic conventions already held have denounced the measure, and the Republicans demand the repeal of the act. This would seem to indicate that the people do not look with favor upon it. The street-railway companies of Chicago will undoubtedly endeavor to take advantage of its provisions at once and secure an extension of their franchises for 50 years under it.

Another attempt will be made by the present city administration of Chicago to compel the street-railway companies to equip their cars with basket fenders. The first attempt failed, owing to the defective manner in which the ordinance was drawn. Mayor Harrison has signed the new fender ordinance, and the measure will become operative on September 1st. It is announced that after that date the companies which fail to equip their cars with basket fenders will be liable to prosecution. The penalty provided is a fine of not less than $25 nor more than $100 for each car operated without safety devices. The companies will fight the law on the grounds that their cars are already equipped with fenders and that the city cannot legislate in favor of any particular style of contrivance.

The subject of "Alternating-current Transformers" has been considered in various lights, but the practical discussion of the topic in Mr. White's paper before the American Institute of Electrical Engineers is undoubtedly one of the most valuable contributions to the literature of the subject, and is especially interesting, as it presents views based on experience gained in the manufacture as well as operation of apparatus of this character. The paper attracted considerable attention at the Omaha meeting, where it was read, and it will doubtless provoke much comment upon receiving wider publicity. It is the first paper that has been published giving the results of a systematic and elaborate series of actual commercial tests on transformers. Mr. White has devoted several years to the study of this particular problem in connection with central-station management, and as his facilities have been exceptionally favorable for the study of this subject his conclusions should be valuable to others similarly situated.

Whatever objection may have been raised heretofore to the proposition that the government lend financial aid to the enterprise for the establishment of the Pacific cable, the recent action of Congress in formally annexing Hawaii makes provision for telegraphic communication with Honolulu an imperative obligation. It is greatly to be regretted that the annexation measure was not adopted earlier in the session, as it might then have been possible to have disposed of the cable question before adjournment.

Never before was the necessity for this great undertaking so urgently impressed upon the public as at this time. Our relations with Hawaii and our operations at Manila make telegraphic communication with the Orient particularly desirable for strategic reasons. Moreover, we are now engaged in extending our foreign trade, and Asia presents a splendid field for operations. We are greatly handicapped at present and will continue to work at a disadvantage as long as we are without direct cable connection with that part of the world.

It is probable that one of the first measures to command attention in Congress next December will be a bill providing for the establishment of a Pacific cable, and it is almost certain that it will differ materially from former measures of this kind by providing for the immediate extension of the cable line to Asia. Hawaii, the Carolines and the Ladrones may be stations in the line to the Philippines. Recent events have broadened the scope of American interests and one of the first improvements required by this changed condition of affairs will be the establishment of the Pacific cable.

An interesting point was raised in the case of the General Electric company against the Morganton Electric Light and Power company, the plaintiff claiming that it had a lien on the property of the latter company for the price of dynamos which it had furnished to replace smaller ones and that the lien was superior to the claim of certain bondholders under a deed of trust which was executed prior to the sale and delivery of the dynamos. The plaintiff claimed that the machines were "material" in the legal sense, as they were fastened by iron bolts to a wooden frame which was built into a brick foundation. But the Supreme Court of North Carolina, before which the question was argued, declares that a piece of machinery, like a dynamo, perfect in itself and capable of being used in one place as well as another, cannot be considered "material," under the statutes of that state. To protect themselves, the court suggests that vendors can retain title by conditional sale or by taking a mortgage on the property sold.

American industrial conditions are now undergoing a marked and important change, and the ultimate result can hardly be anticipated. For many years this country has been among the leading nations of the world as a producer of manufactures as well as of raw products, but it has been absorbed with its own internal development and satisfied, for the time being, with the enormous home market of 70,000,000 of people, and until recently it has devoted but little concerted effort to the sale of its manufactures outside of its own borders. Now, however, it is apparent that the output of our manufacturers is largely in excess of the demands of home consumption, and it is not surprising that greater interest is being manifested among manufacturers, exporters and economists in the enlargement of foreign markets for American goods. Heretofore but little concerted action has been apparent among exporters, but many lines of American manufacture, notably machinery, electrical apparatus, bicycles, and other products of iron and steel, have already been introduced into European countries and are finding ready sale in competition with home products. This condition is explained in several ways, principally on the ground of comparative cheapness which, notwithstanding the higher rates for labor, can be attained through superior producing capacity of American workmen with the aid of improved labor-saving machinery. It is gratifying to observe that the business community seems already to have learned the significance of the industrial opportunity, as is shown by the organization of the National Association of Manufacturers, the Philadelphia Commercial Museum and export associations and clubs in commercial centers, with the object of finding larger markets for American goods. The increase in the volume of correspondence of the State Department with business houses, organizations and individuals throughout the country has been so great that Congress has made provision for additional facilities, and an appropriation has been passed to enable the department to supplement the mail reports of consuls with cablegrams, notifying it immediately of any important commercial or industrial event. As a result commissions composed of commercial and industrial experts will be sent abroad to study the actual conditions in promising markets. Such commissions have been appointed from time to time with favorable results, but heretofore government inquiry of this character has been directed mainly to sister republics of the Western Hemisphere. While it is claimed that the results obtained have been largely in the nature of preparation for, rather than in actual performance of, the great task of obtaining a larger share of Latin-American trade, it is believed that the efforts have not been wasted, and that their continuance under intelligent direction will soon bear fruit.

WAR NEWS.

The Cable at Santiago.—The negotiations for the surrender of the city of Santiago de Cuba to General Shafter, the commander of the American army that has invested the place, gave some insight into the conditions of submarine telegraphing that exist there. An official dispatch from the American commander, dated in camp, near Santiago, on July 7th, recites that "at the request of the Spanish general, employes of the English cable company were sent in to him to telegraph his government as to surrendering." Two days later General Shafter telegraphed: "Cable operators were permitted to go in yesterday morning. The English cable was in working order and some of the operators were in the city. General Toral wanted them there, as they were the principal men. This cable has not been cut, and the men I sent in have not taken it up again. English cable has been working all the time through to Havana."

This interesting episode of the war is described with greater detail by a correspondent of the New York Sun. His dispatch was dated Siboney (near Santiago), July 7th, and in it he said: "General Toral asked that the time of the truce be further extended, as he wanted to communicate with the Madrid government concerning the surrender of the city. He also asked that cable operators be sent to operate the line between Santiago and Kingston. He promised on his word of honor as a soldier that the operators would not be asked to transmit any matter except that bearing on the surrender, and that he would return them safe to El Caney when a final reply was received from Madrid. This request for operators was made necessary by the fact that the men who had been operating the Santiago cable were British subjects, and they had all left the city under the protection of the British consul when the Americans gave notice that the city would be bombarded unless it surrendered. The commissioner said that General Toral wanted to consult with the authorities in Madrid, for the reason that he had been unable to communicate with Captain-General Blanco in Havana. It was finally arranged that the truce, which expired at four o'clock yesterday, should be extended until the same hour on Saturday. The commissioner was escorted back through another part of the camp which was filled with bristling guns. The British consul having given his consent to the operators returning to the city, messengers were sent to El Caney to learn if the men would go. They expressed their willingness, and were escorted to the walls of the city, where they were met by a Spanish escort and taken to the office of the cable company, where they began work at about four o'clock yesterday afternoon."

It is stated that the French cable between Hayti and Santiago has been repaired, so that communication is now possible with the city of Santiago itself. This line is the one over which the government dispatches are being sent, but since the line was cut by our navy communication with Santiago has been cut off. The line was placed in working order, however, so that Guantanamo and Playa del Este could be used for the army, but it was not until last week that the last break in the cable was mended and the line made complete between Hayti and Santiago de Cuba. The government has made an agreement with the French cable company by which dispatches may be filed in Santiago, provided they are not addressed to persons in Spain, and are subject to censorship at Playa del Este.

Other Cable News.—A dispatch to the London Daily News from Madrid says that the Spanish government is unable to communicate with Cuba because the English cable company refuses to transmit cipher dispatches. The Spanish government instructed the Spanish commission in London to take measures to compel the company to fulfill its contract. The commission replied that it was impossible to reach a satisfactory agreement. The government insists upon the transmission of its dispatches, and asks whence the order to refuse them was issued. The newspapers blame the British government for the company's action.

The president directed that Admiral Cervera be allowed to cable his family in Spain that he is alive and well and being well treated, and Cervera did so. The president also ordered that the prohibition of communication with Spain be sufficiently raised to allow a similar courtesy for all other captured Spanish officers. General Greely says that his instructions are to be very rigid in his scrutiny of the messages. The messages must all be plainly personal.

It is reported from London that cable communication direct with Manila will be opened in a few days. Negotiations are now said to be progressing between the Eastern Telegraph company and the British ambassadors to the United States and to Spain. London Manager Hibberdine of the company said on Tuesday: "We hope to have the cable repaired soon. The difficulty hitherto has been the impossibility to get the rival governments to agree on the matter. Each insisted on having control of the cable. What we are trying to accomplish is to gain permission from both the United States and Spain for our company to make the repairs independently and operate the cable as a private corporation. I believe this will be arranged, but I cannot tell where the landing will be. The repairs will take only a few hours, as the cable is cut in the bay close inshore. As soon as the two governments give their consent we will send the cable ship from the Chinese coast, and within a day after its arrival the Manila line will be ready for messages."

The Signal Service.—Excellent progress has been made in recruiting for the Volunteer Signal Corps, which has been going on under Colonel Dunwoody, who says there was plenty of material offered. There is to be a company of signal men for each division in the army. The organization of 12 companies is now in progress, and their captains have been selected as follows: First Company, Elmore A. McKenna; Second Company, Howard A. Giddings; Third Company, Frederick T. Leigh of Brooklyn; Fourth Company, Charles B. Hepburn of Iowa; Fifth Company, William N. Lamar; Sixth Company, Charles N. Connor of St. Louis; Seventh Company, John McConnell of Chicago; Eighth Company, George W. Butler; Ninth Company, Edward B. Ives of New York; Tenth Company, Thomas F. Clark of Boston; Eleventh Company, Carl F. Hartman of Newark, N. J.; Twelfth Company, Frank Lyman of Des Moines. In the Signal Corps telegraphers, electricians and linemen are wanted. It is said to be the best paid branch of the service. The pay of privates is $20.50 a month; first-class sergeants get $45.

The Ninth Company of the corps, under command of Captain Ives, was recently at Newport-News, Va., and is probably now on its way to Santiago, where signal-service reinforcements are needed. It comprises five officers and 55 men.

Major George P. Schriven of the Signal Corps has been ordered to go to Manila on the Peru and report to General Merritt.

Fifty-five men, comprising Indiana's quota in the United States Signal Service Corps, have left Indianapolis for Washington. The company is under command of Captain Charles McIntyre, for many years a member of the Indiana National Guard.

That part of the government Signal Corps organized in Montana, consisting of about 20 telegraphers and electricians, under the command of Lieutenant George H. Tilley, which has been stationed at Helena, left that city on July 9th and is now on the way to Manila on "hurry" orders received from Captain Bartlett, in charge of the bureau at Washington. In the order to move immediately to San Francisco it was said that the telegraphers were to accompany the fourth Philippine expedition, which was expected to leave that city on July 14th. Lieutenant Tilley was formerly a New York telegrapher. For some time he had charge of the Montana State Signal Corps. His men have been drilled thoroughly and are equipped fully.

Volunteer Engineers.—An eastern contemporary states that Lieutenant E. J. Spencer of St. Louis, a former army officer and a well-known electrical man, has been nominated to the lieutenant-colonelcy of the Third Regiment of Volunteer Engineers by President McKinley.

The completion of the organization of the First Regiment of Volunteer Engineers is proceeding satisfactorily at Camp Townsend, near Peekskill, N. Y., where headquarters have been established. The regimental roster is now nearly complete, but it is possible that one battalion may be sent to Cuba before the regiment, as a whole, is completely mustered in. There is a large number of electrical men in this regiment.

Private Francis M. Blacklock of the First Regiment United States Volunteer Engineers, at Camp Townsend, Peekskill, N. Y., has been promoted to the rank of sergeant. Private Blacklock was an electrician of the Niagara Falls Power company and volunteered his services at the first call to arms. He enlisted in the Forty-second Separate Company of Niagara Falls, now Company E, Third Regiment, New York Volunteer Infantry, as a private. His application to be transferred to the engineers was granted a week ago, and he was transferred to Peekskill, where the regiment is now being formed. His knowledge of electricity and engineering secured him the promition he has received.

Thirty-five members of Company B, United States Engineer Corps, arrived at Newport News, Va., last week and encamped in emergency tents near the Signal Corps. The men have been stationed for some time at Willets Point, Long Island, and came directly from that place.

Miscellaneous Notes.—The Engineers' Club of New York, which cabled its congratulations to Dewey upon his victory at Manila, received the following acknowledgment:

Flagship Olympia, Manila, May 24.

Sir: Admiral Dewey wishes me to express to the Engineers' Club of New York his high appreciation of the action of the club in cabling congratulations to himself and to the members of the Engineer Corps attached to this squadron upon the naval victory of May 1st. The telegram was read on the quarter deck of all vessels of the squadron with all bands at muster. Such prompt appreciation of services rendered to the country is a great incentive to continued effort. Very sincerely,

T. M. BRUMBY, Flag Lieutenant.

Secretary Engineers' Club.

A Paris correspondent complains that the Spanish censor has stopped most of the telegrams sent from Madrid to newspapers in the French capital.

The auxiliary cruiser Yankee was in port in New York last week. This ship has taken an active and honorable part in the naval operations in Cuban waters, and is expected to make one of the flying squadron to be sent to Spain. Several electrical men are serving in the ship's company. S. Dana Greene of the General Electric company is an acting lieutenant.

Alternating-current Transformers From the Station Manager's Viewpoint.[1]

By W. F. White.

In the early days of alternating-current [illegible] development, many a sale of [illegible] transformer equipment was lost to direct-current [illegible] by the facts, figures and fancies which [illegible] of direct-current apparatus was able to [illegible] concerning the wastefulness of energy, the expense of maintenance and the danger to life which purchaser must accept as inseparably [illegible] any transformer system.

Notwithstanding that the danger to life [illegible] fortunately made much of and the facts grossly misrepresented, still the correctness of many of those arguments, in the light of present knowledge, stands up remarkably well under the scrutiny of qualitative analysis. And it is even more remarkable, in view of the natural tendency to exaggerate induced by zeal to make sales, how little, if any, were the facts of these evils overdrawn or magnified. Quantitative analysis in fact proves that most figures then given to show the amount of transformer "leakages" were understated. On the part of salesmen this was undoubtedly more a mistake of the head than of the heart, for while some few of them knew the results of some isolated tests of some particular size of one type or manufacture of transformer, no one, whether salesman, engineer and designer, or manufacturer, had any knowledge or conception of the cumulative effect of transformer loses on the station output. Such little knowledge as had then been acquired related more to the transformer efficiency under certain percentages of rated load, than to all-day efficiency, or the 24-hour ratio of energy output to energy absorbed under average conditions.

Little, if anything, was known of transformer core losses, and the effect of power factor on station and line capacities had not had consideration. As long ago as 1892 the writer, in making a careful examination into the operations of one of the then largest alternating stations in this country, made the discovery that with a net meter rate to consumers of about 20 cents per 1,000 watt-hours, the income per kilowatt-hour output at the switchboard was only about six cents, showing an average loss from station switchboard to consumer's meter of about 70 per cent.

Current was supplied in accordance with the then existing universal practice through one or more transformers for each customer. In two or three cases, for large installations, as many as 18 or 20 transformers were erected for a single customer, no transformer of more than 75 lights capacity being used. The transformer primaries were connected in multiple, the secondaries feeding entirely distinct and separate circuits.

Of each 1,000 watt-hours output at the switchboard, it was estimated that approximately 300 watt-hours were delivered through the customer's secondary meter, 600 watt-hours were accounted for by transformer core losses, leaving 100 watt-hours to be accounted for by transmission and other losses.

A statement of these conclusions to a well-known manufacturer, who supplied the wattmeters and many of the transformers, elicited the opinion that either the primary meters registered too fast or the secondary meters too slow.

A meter expert from the factory accordingly spent several weeks in testing all primary and secondary meters, found them correct, and proved that the apparent discrepancy was not due to the meter end of the plant equipment. With the writer's recommendation that a three-wire secondary network be erected, using 100-volt lamps, and fed through large transformers at frequent centers of distribution, the matter was dropped; but there is no doubt that the proportion of the otuput attributed to transformer losses was approximately correct.

Since that time it has been the writer's good fortune to be in touch with a considerable number of alternating plants, giving him knowledge of their operating results, and he does not hesitate to assert that very few plants exist, giving continuous service, using separate transformers for individual customers, and charging from 12 to 20 cents per 1,000 watt-hours, secondary meter measurement, whose income per kilowatt-hour output at the switchboard exceeds from four cents to seven cents. In other words, the transmission, transforming and distribution losses are commonly as much as 200 per cent. of the customers' demand, as shown by the customers' meters. This does not mean operating expenses three time as great as if all these losses were eliminated, but it does mean that large expenditures are made for fuel and feed water for the keeping warm of numerous transformers operating about 20 hours per day with open secondaries. And great numbers of small transformers also mean great variations of secondary voltage, large bills for lamp renewals, unsatisfactory service and a reduced number of lamps which can be served at any instant from a given generator capacity. To show the benefits to be derived by using a secondary network, fed by large transformers working in multiple, but located one at each feeding point or local center of distribution, as compared with the use of small transformers, one or more to a cus-

[*Continued on page 38.*]

1. Read at the fifteenth general meeting of the American Institute of Electrical Engineers, Omaha, June 29, 1898.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Telephony at the Trans-Mississippi Exposition.

The conspicuous position occupied by the independent telephone industry in the electrical and financial world is fittingly exemplified at the Omaha exhibition by the excellent representation of two of the most prominent manufacturers of this class of apparatus. It is certainly fortunate that both of these companies have placed complete lines of their standard apparatus on exhibition, as it gives many intending investors an opportunity to examine the merits of the respective systems. It is unfortunate, however, that the Bell apparatus is not at hand for comparison, but it is promised that a complete exchange equipment will be in working order in the Electricity building before the end of the month. The apparatus displayed by the independent companies at Omaha is well constructed and is according to the best modern designs. It compares favorably with the Bell equipment.

FIG. 1. INDEPENDENT TELEPHONY AT THE TRANS MISSISSIPPI EXPOSITION.—EXHIBIT OF WESTERN TELEPHONE CONSTRUCTION COMPANY.

Western Telephone Construction Company.

This concern has an elaborate exhibit, showing every form and style of standard apparatus which it manufactures. The illustration, Fig. 1, shows a corner of the booth, which occupies a conspicuous position in Machinery and Electricity building. The central feature in the picture is the switchboard, which is the regular commercial board of the Western Telephone Construction company, and the excellent workmanship shown in its construction occasions much surprise among visitors whose ideas about the apparatus turned out by independent companies has been gained through representations of the Bell company's officials. The combined lightning arrester, distributing and change board, which is also shown in this exhibit, is admitted to be in accordance with the best modern practice. Other equipments, including a 200-drop improved table switchboard and a 100-drop improved switchboard for metallic or common-return systems, also occasion favorable comment. The No. 1 improved switchboard, which has attracted considerable attention is compact, durable and economical. One feature tending to increase the facility with which this board may be handled is that the same movement by which the operator places the plug in the jack after a call mechanically restores the drop. The drop hangs directly in front of the spring-jack, and the plug must restore it before entering the spring-jack. The entire space occupied by 100 jacks and drops, complete, is but 14 by 14 inches. This board is provided with patent circuit-changing levers. By a simple movement of one of the levers, the operator can connect her telephone across the circuit of two subscribers who are talking, or can ring either one of them. Clearing-out drops are provided for each pair of plugs, and are provided with a special winding in such a manner as to render them absolutely non-inductive without decreasing their magnetic efficiency. The wiring is neat and the board is mounted in a handsome cabinet of quarter-sawed oak. Other parts of the exchange equipment are equally well made. A power generator for switchboards, provided with a slate base, a new type of bridging generator, a repeating coil and an operator's receiver and head band are included in the display, as well as all the parts of a dismantled switchboard and sections of the distributing board. Linemen's test sets and instruments for construction and repair gangs are displayed. A variety of subscribers' instruments is also shown, ranging from the simple wall form to cabinet desk sets of highly finished material, with beveled-glass front or mirror. There are also many forms of instruments, among them being the swinging-arm desk set, gooseneck transmitter arm, portable transmitter stand, portable rocker arm desk set and the Western rocker arm and transmitter. The adjustable-arm transmitter is described as a "combined long-distance and exchange instrument" of the solid-back type, mounted in fine cast-nickeled box with hard rubber back. The induction coil is of special winding, mounted in the base of the adjustable arm. Screw and washer terminals are provided and soldered connections are made. Four insulated binding-posts are mounted in the base of the arm for the attachment of primary and secondary circuits. The construction of the coils is such that, used in combination with the transmitter, the greatest volume and sensitiveness is secured with a minimum amount of battery power. The length of the base of the arm is 5¼ inches, thus allowing it to be mounted on any back board between the magneto bell and battery box.

In addition to the regular apparatus for exchange and private lines, the company has developed a complete system of police, fire-alarm and railway-patrol boxes. Instruments of this character are also included in the exhibit.

American Electric Telephone Company.

Standard apparatus and equipments of special design, manufactured by this company, are arranged in the artistic booth near the eastern entrance to the Machinery and Electricity building, which is represented in Fig. 2. In one corner is the sound-proof booth for pay stations, containing a cabinet set for long-distance work. This is constructed of handsomely finished wood, with plate-glass door and magneto bell. A cabinet desk set, equipped with a long-distance transmitter with a 500-ohm induction coil, occupies a prominent place in the collection. In the line of station equipment the special feature of this exhibit is a complete 100-drop express switchboard. This board is a new departure, with self-restoring drop, self-restoring ring-off and rapid-ringing device. Each drop and jack is self-contained in a hard rubber case and can be removed and replaced in the board in one minute without disturbing a single connection. Each drop indicates if the line is working properly. The experience of the company enables it to furnish switchboards of any desired capacity, from 10 to 3,000 drops, wired for common-return, grounded circuits, or complete metallic, for use with series or bridging telephones or combination of both. Particular attention is given to the design and construction of boards to meet special requirements of service. Another specialty is the Universal telephone exchange switchboard, for single lines and metallic circuits, of the magneto bell system. The act of putting a connecting plug in a spring-jack rings the subscriber called for. The board is compact, 100 drops being 20 inches wide, or the necessary width for the operator to sit comfortably. Everything that is necessary for the complete equipment and operation of a first-class exchange is included in the apparatus displayed. The operator's head receiver and the exchange chair are among the specialties that may be enumerated. Batteries, carbon lightning arresters, five-point extension bell switches, fusible cut-outs, water motors and power generators, linemen's test sets and repeating coils are also shown, and their operation explained. Subscribers' outfits in several forms are displayed. The standard forms of American series telephones are equipped with generators of special power, having large field magnets of best quality of magnetic steel, laminated armatures with ample wire space, securing large output and wound to ring through a resistance of approximately 15,000 ohms, polarized bells with central pivoted armatures, having high coefficient of self-induction and reliable means of adjustment, automatic shunts of positive action, long-lever gravity switches and silk-wound induction coils. Several handsome desk

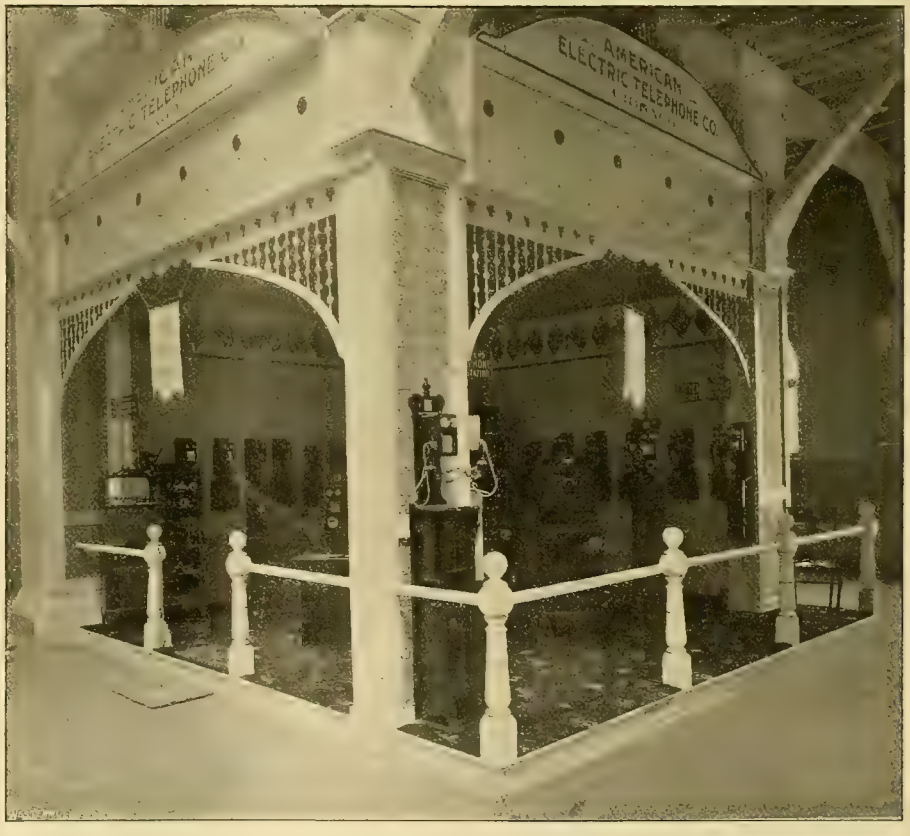


FIG. 2. INDEPENDENT TELEPHONY AT THE TRANS-MISSISSIPPI EXPOSITION. EXHIBIT OF AMERICAN ELECTRIC TELEPHONE COMPANY.

sets are included; there are also a transmitter and receiver combined, a transmitter and arm and several forms of American-Hunnings transmitters. One of the most attractive instruments in appearance and working quality is the new American amplifying transmitter, especially built for long lines and severe service. It is used on "special No. 12," which comprises a double-cell battery box, provided with a long-distance type silk-wound induction coil mounted in the bell box, a magneto generator wound to ring through approximately 15,000 ohms resistance and having an automatic shunt, call bells with centrally pivoted ringer armatures, Bell style receivers with compound magnets in hard-rubber shells, long-lever gravity switch hooks, Watson wiring and two cells of solution battery. This instrument is adapted for both long and short-distance work. Its chief claims are simplicity, ease of access to all parts for purposes of inspection, general efficiency, durability and neatness of appearance. It is furnished in woodwork of walnut or oak, as preferred. A description of this exhibit would not be complete without mention of the Burns receiver, which is attracting so much attention. This is a new double-pole adjustable receiver, embracing features possessed by no other receiver on the market. It combines sensitiveness, loud talking qualities, positiveness and ease of adjustment and accessibility of all parts for the purpose of inspection and repairs.

As an illustration of the character of the work performed by this company the exchange at Grand Rapids is referred to. The Citizens' Telephone company of that city is equipped with American apparatus, and, according to the exchange directory, the business has grown from 400 instruments in use June 1, 1896, to 4,102 on October 20, 1897. This number includes 2,028 state-line telephones distributed throughout Michigan and reaching 127 points. The fact that satisfactory service can be given over such an extensive territory from one exchange is accepted by telephone men as sufficient proof of the high character of the equipment employed.

Victor Telephonic Apparatus.

The debutanté of the recent telephone convention was the Victor Telephone Manufacturing company of Chicago. This company made its first display at the convention and a general idea of its exhibit at the Palmer House on that occasion was given in the picture that was presented in the last issue of the Western Electrician. The accompanying cuts, however, show in detail some of the essential Victor instruments.

The outfit presented in Fig. 1, or the Victor "A," as it is called by its manufacturer, was especially designed for long-distance and exchange work, where a strictly first-class instrument is desired. The woodwork is quarter-sawed oak, neatly carved and highly polished. The battery box is constructed so as to use from one to three cells of ordinary wet battery, as the case may require, one above the other, thus doing away with the wide battery box commonly used. The generator and ringer are made after approved designs, with the best material and workmanship that can be procured, and are guaranteed to give a strong ring through 15,000 ohms resistance. The Victor transmitter is of the long-distance type, and is mounted on an adjustable arm. The Victor special double-pole receiver has hard rubber shell, compound magnets, and is fitted with a special device for keeping the adjustment.

The Victor "B" is the same in every respect as "A," with the exception that it is wired for multiple or bridging work, and has special ringer and induction coils for toll-line work. This instrument is particularly recommended for toll-line work.

The Victor double-pole receiver is shown in section in Fig. 2. This instrument has powerful compound magnets, assembled in a hard-rubber case, and fitted with the Victor special device for keeping the poles constantly in the same position with the diaphragm. The spools are wound with No. 36 silk-covered wire. All connections are soldered and thoroughly insulated.

The Victor long-distance adjustable arm transmitter is shown in Fig. 3. The box and arm are neat in design, highly finished and ornamented. The instrument is very sensitive, powerful and clear in articulation. The transmitter head is made of hard rubber, so as to prevent the absorption of moisture and the consequent packing of the granules. The company claims it has over 10,000 in use. These instruments have a 500-ohm induction coil.

One of the most important of the Victor instruments is its switchboard. The points of superiority claimed by the company over other boards are that it is neater in design, better in construction, more economical in operation and absolutely free from infringing any patents. The cabinet work is of highly finished oak, with nickel and German silver trimmings, making a very attractive instrument for an exchange office. The working surface of each 100-section is 14 by 21 inches, making the most convenient possible size for ease and rapidity of operation. The method of plugging is so arranged that only about half the time ordinarily required on other boards is needed to make a connection between any two subscribers. These boards are put up either for metallic or single-wire circuits in any size to 3,000-drop.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

H. L. Sumption and Irving Todd, Jr., of Hastings, Minn., have been granted a franchise for a telephone exchange at Red Wing, Minn.

The Iowa and Nebraska Telephone company has connected with Sutherland, Ia.

The Iowa Telephone company has moved into new quarters at Muscatine, Ia.

The Iowa Telephone company has answered the Board of Public Works at Des Moines, Ia., refusing to comply with the orders of the City Council to vacate the streets of Des Moines. The company has instructed its attorneys to take such action as may be necessary to protect its rights.

The Northwestern Telephone Exchange company differs from a number of other corporations in the Northwest, in its treatment of the matter of internal revenue on long-distance telephone messages. It announces that it will pay the tax on all messages costing over 15 cents.

The commissioner appointed to appraise lands for the Northwestern Telephone Exchange company in the neighborhood of Lamberton, Minn., were not received in a very cordial manner by some of the farmers, who did not want their groves crossed.

The Blue Earth Valley Telephone company has bought a new switchboard and 40 new instruments for its Blue Earth City, Minn., exchange.

The Northwestern Telephone Exchange company will establish a telephone exchange at Merriam Park, between Minneapolis and St. Paul, at once.

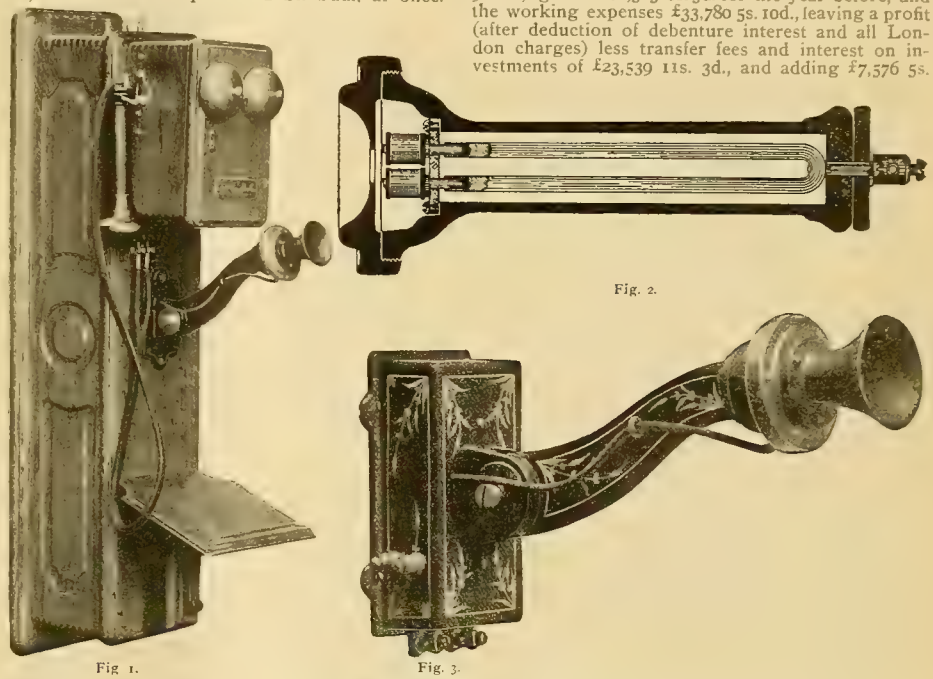


Fig. 1. Fig. 2. Fig. 3.

VICTOR TELEPHONIC APPARATUS.

The company will soon begin work rebuilding its St. Paul exchange and introducing modern appliances, similar to the system just introduced in Minneapolis. It will cost in the neighborhood of $100,000.

The Western Electric Telephone company has connected with Lake Benton, Minn., and is rapidly pushing into South Dakota.

The Iowa Telephone company has extended its lines to Keystone and Elberon, Ia.

Baxter, Ia., expects to have telephone connection this month.

Lightning split and splintered a number of telephone and telegraph poles at Sioux Falls, S. D., in a recent storm.

It is understood that steps will be taken to forfeit the franchise of the Mississippi Valley Telephone company in St. Paul, for not beginning work by June 7th. It is thought that this action has been instigated by the Bell company. The company has a large amount of material in the city and has every appearance of being ready to begin to put in an exchange for 1,800 subscribers.

The Northwestern Telephone Exchange company will at once begin work on its Little Falls, Minn., exchange, changing it from an automatic system to a central office.

The Wisconsin Telephone company is an applicant for a franchise for a telephone exchange at Jefferson, Wis.

Independent Telephone Association.

President James M. Thomas and E. B. Fisher, representing the Independent Telephone association, visited Chicago last week and called upon representatives of the electrical corporations interested in telephone matters, for the purpose of securing active support of the independent movement. They report that they were received everywhere with consideration, and that the manufacturers and dealers in supplies assured them of hearty support and encouragement.

Extensions and Improvements.

In his official report for 1897, the British consul-general of Frankfort-on-the-Main, Sir Charles Oppenheimer gives some statistics relating to the imperial German telephone system. State telephones exist at 488 stations, with [illegible] total number of telephonic conversations was 562,000,000. The numerous requests for a reduction in the state telephone charges have as yet proved unsuccessful.

The London County Council's report of the proceedings of the conference between local authorities of other towns and a committee of the council, to discuss the question of telephone service, states that the conference expressed the opinion that the telephone service ought not to be left permanently in the hands of a private company, and that municipal authorities should be empowered to provide such service.

The long-distance telephone line between Sydney and Bathurst, Australia, is being rapidly pushed forward. It seems probable that the postmaster-general will eventually decide to construct a line to Goulburn. The great success of the Newcastle line is certainly encouraging, and, although the population of Bathurst and Goulburn may be insufficient to support the line at present, the intermediate towns will help to make the enterprise pay.

The report of the directors of the United River Plate Telephone company (limited) for the year to March 31st states that the gross receipts were £67,208 9s. 8d., against £60,325 6s. 5d. for the year before, and the working expenses £33,780 5s. 10d., leaving a profit (after deduction of debenture interest and all London charges) less transfer fees and interest on investments of £23,539 11s. 3d., and adding £7,576 5s. 11d. brought forward and the amount of paid taxes refunded by the municipality of Buenos Ayres (estimated to produce £6,240), leaves an available balance of £37,355 17s. 2d. The directors propose to transfer £3,000 to depreciation and £10,000 to reserve, and recommend a dividend of six per cent. free of tax on the ordinary shares. The increase in the company's business from 4,758 subscribers on March 31, 1893, to 7,238 March 31, 1898, has necessitated large additions and improvements to the plant. The new central-office building will, it is expected, be ready early in the year 1899.

"Some Experiments with the Telephone" was the title of a lecture delivered at the Royal Institution in London recently by Lord Rayleigh, in which he first called attention to the fact that by means of the telephone currents of one-millionth of an ampere can be made audible, and then proceeded to show some experiments by means of flames, which were arranged so as to increase the ordinary four-inch pressure to 10 inches, by means of a chamber around the burner covered with tissue paper, which excluded air but not sound. The flame was carried up a brass chimney, and thus rendered more sensitive at its ultimate contact with the air. The action of the sound upon the ear or the telephone was described as push-and-pull action. The action of self-induction was shown by inserting a bundle of iron wires into a coil which made the connection to the supply. This rendered the light dimmer at once, showing the increased self-induction although the resistance remained the same. Speaking affected the flame visibly; clapping the hands or sharp sounds extinguished it altogether. An index showing the variation of pressure caused by sound was thrown on the screen. An improvement on Professor Hughes' induction balance showed how a shilling piece placed on one side of the balance reduced the flame, while another shilling placed on the opposite side restored the balance. Even a threepenny piece produced a visible effect.

Alternating-current Transformers from the Station Manager's Viewpoint.

[Continued from page 35.]

tomer, the writer presents some results accomplished by an existing plant in remodeling its transformer system in accordance with these ideas.

On January 1, 1895, this plant was serving 16,702 incandescent lamps (16 candle power equivalent) through 547 transformers of 22,190 lamps rated capacity, each transformer averaging 40.6 lamps capacity and serving 30.6 lamps. The transformer load, with open secondaries, was, as near as could be determined, about 80 amperes at 1,000 volts. In view of the fact that the maximum load never exceeded 50 per cent. of the lamp capacity connected, it was evident that a very considerable reduction could be made both in the number of transformers connected and in their aggregate capacity, by the use of a secondary network. The theoretical limit was to reduce the transformer capacity to equal the maximum load, which would lower the capacity connected from 22,190 lamps to about 7,000 lamps, a reduction of about 64 per cent. This limit was evidently impossible of attainment because of the large number of isolated installations, especially in the residence districts, requiring individual transformers, which of necessity must generally be of capacity equal to several times the average load. A system of three-wire secondary networks was laid out and estimates made showing a possible reduction of almost 80 per cent. in the number, and of about 50 per cent. in the lamp capacity, of transformers connected. A large number of tests of core losses of all sizes of transformers in service was then made, for estimating the total core losses for the plant, and for comparisons with the estimated core losses of the large transformers to be erected in replacing the old.

An illustration of one or two of these comparisons may be of interest. One installation of approximately 700 lamps was fed through a large bank of small transformers having an aggregate core loss of 4,440 watts, which could be replaced by two transformers having a combined estimated core loss of 310 watts. On the basis of the number of watt-hours per pound of coal then being produced by the plant, no taking into account any line losses, this example shows the following result:

4,440 watts,	38,894,400 watt-hrs	per year requires	190.6 tons coal.
310 "	2,715,600 "	" " "	8.4 " "
Annual saving	36,178,800 watt-hours		182.2 tons coal.

The annual income from this installation was about $2,100, at 12 cents per 1,000 watt-hours. With a secondary output of about 17,800,000 watt-hours, and transformer core loss of about 38,894,400 watt-hours, the income per kilowatt-hour output at the switchboard for this installation was evidently less than four cents, and the core losses were more than double the total secondary output.

In another case, one section of the city, comprising 10 city blocks, was fed by one dynamo and circuit through 71 transformers, having an aggregate rated capacity of 4,482 lights, and aggregate core losses of 10,402 watts (estimated), or 91,121,520 watt-hours per year.

To replace these transformers, a three-wire secondary network was erected, supplying all customers, and fed by five 400-light transformers, located at as many feeding points or local centers of distribution. Each transformer was provided with primary and secondary switches, by means of which each night all transformers were thrown into service from dusk until midnight, at which latter hour four transformers were cut absolutely out of circuit. On a yearly average five transformers were in circuit about six hours per day, and one transformer the remaining 18 hours per day. The combined core losses of the five were about 1,250 watts, and for the hours in service aggregated about 4,380,000 watt-hours per year. Some results of the above changes on this one circuit therefore were as follows:

Number of transformers.	Lights capacity.	Total core losses—watts.	Total annual core losses—watt hours.	Equivalent tons coal.
71	4,482	10,402	91,121,520	436.7
5	2,000	1,250	4,380,000	21.5
Saving	2,482	9,152	86,741,520	415.2

A reduction of over 95 per cent. in core losses, and a saving for one year in cost of fuel alone of $815.40 were effected for this one circuit. These examples were extremes, because the lighting covered by them was concentrated; and because in most residence and outlying business districts few changes in the number and capacity of transformers could be made. The results shown by the last example were therefore much above the average for the whole plant, but serve to show the possibilities of such changes and the methods pursued in this case.

Some results for the plant as a whole may therefore be fairly indicative of what other average plants operating under similar conditions may accomplish in the same direction, and were as follows:

Time.	Lamps connected.	Transformers connected.	Total capacity.	Average lights capacity.	Average lights served.
Jan. 1, 1895...	16,702	547	22,190	40.6	30.6
Jan. 1, 1896...	19,282	201	15,565	69	90.1
Jan. 1, 1897...	20,262	152	15,498	88.8	133.3
Jan. 1, 1898...	23,643	121	14,926	106.	167.7

Year.	Income.	Switchboard output, K. W. hours.	Income per K. W. hour output.	Increase of income per K. W. hour output.
1894.....	$59,012.71	928,400	$ .0635	
1895.....	54,231.67	791,752	.0684	7.7 per cent.
1896.....	51,415.29	551,064	.0933	46.9 per cent.
1897.....	56,317.42	508,070	.1108	74.5 per cent.

Year.	Actual K.W. hours output.	Estimated K.W. hours output—basis 1894 Conditions.	Estimated K.W. hours saved by change.	Estimated saving in coal—1894 basis.	
				Tons.	Cost.
1894.....	928,400				
1895.....	791,752	854,042	63,290	310.2	$ 670.91
1896.....	551,064	809,689	258,625	1,267.8	2,641.42
1897.....	508,070	886,888	378,818	1,856.9	4,015.43

It must be borne in mind that the number of 16 candle power equivalents connected January, 1895, was 16,702, and increased by January 1, 1898, to 23,643, or more than 41.5 per cent. The savings estimated in last table are based on the conditions at the beginning of this period, i. e., the same number of transformers and the same transformer capacity. But if the same conditions had obtained throughout, an increase of 41.5 per cent., or 226 transformers, of 9,208 lights capacity, would have been added to supply the new lights connected. And while only a part of the core losses of the transformers in service January 1, 1895, was saved by the change, the entire losses of the 227 transformers, which would have been required by increased business, were saved. It is therefore perfectly safe to add 50 per cent. to the savings shown in the last table, in estimating actual benefits. From reduced core losses alone, therefore, there is an annual saving of approximately $6,000.

In core losses alone, the savings already affected have more than paid all costs of the entire change of lamps, meters and transformers (for because of a simultaneous change from 52 volts to 106 volts, secondary, all lamps and meters also had to be changed), and of the erection of secondary network; and the annual saving of $6,000 is equal to six per cent. interest on $100,000, secured without one dollar invested.

To be certain that the saving of fuel was in proportion to the reduction in kilowatt-hours output, as estimated, the plant efficiency under the changed conditions must be known. It is therefore pleasing to note that, using coal from the same mine most of the time, the watt-hours output per pound of coal actually increased for 1896 by 3.8 per cent., and for 1897 by 5.9 per cent. over 1895, so that the saving in fuel was at least not less than in proportion to the saving in kilowatt-hours output.

Some incidental advantages of the change may be mentioned:

First—Under the old plan, the 6,941 lights added would have required about 9,200 lights additional transformer capacity, of 40 lights average size, of $1 per light average cost, giving an investment saving of $9,200.

Second—The transformer load, with open secondaries, of 80 amperes, was reduced, by the fall of 1897, to about 30 amperes, notwithstanding an increase of about 25 per cent. in the number of lights connected. A saving of 50 amperes at 1,000 volts represents a capacity to serve, without additional station or line equipment, approximately 1,000 16 candle power equivalents, all burning at one time, or fully 2,000 16 candle power equivalents connected.

Third—Formerly as many as a dozen transformers were frequently burned out in a single thunderstorm. Ten per cent. of the transformers connected would be a conservative estimate of the number burned out each year from various causes. Of the new transformers connected during the past three years only one has failed from any cause, and that one was defective, and burned out under light load almost immediately upon being put in service. Transformer repair costs are therefore practically eliminated.

Fourth—Incandescent-lamp renewals have been greatly reduced. Using lamps from the same factory of the same efficiency, and bought at the same price per lamp, the cost (estimated) of renewals per kilowatt-hour consumed by the lamps has been reduced from $.0081 in 1895 to $.0057 in 1897, a reduction of 29.6 per cent. This saving represents the advantage of regulating the secondary voltage by pressure wires connected to the secondary network, as compared with the former method of regulating the primary voltage by station transformers.

Fifth—The principal remaining incidental advantage is the uniformity of voltage, bringing uniformity in quality of service and the consequent satisfaction of customers, the value of which cannot be estimated in dollars or percentages. These are some actual results, and such as any plant operating under similar conditions can achieve at small expense, if the changes are well planned, and the replaced apparatus sold to the best advantage.

In this connection attention must be called to one other fact, which is that central stations using separate transformers for individual customers have the great majority of their transformers working on open secondaries probably 80 per cent. of the time. The best transformers have a power factor of about 50 with open secondaries, and of fully 99.9 with almost any load they carry in practice. It is therefore perfectly credible, and the writer has demonstrated it to be so by many actual tests on various plants, that the average power factor of plants operating under above specified conditions is approximately 65.

It scarcely needs demonstration that if, instead, a secondary network is used, and only such transformers allowed to remain in circuit at periods of light load as are required to advantageously carry such load, the average power factor will be approximately 100. The volt-ampere hours therefore, calculated from the station voltmeter and ammeter readings, give approximately the watt-hours output. But almost all existing plants use separate transformers for individual customers, and the great majority of them do not have primary wattmeters on their switchboards, and do not calculate their volt-ampere hours output as equivalent to watt-hours, getting results about 50 per cent. in excess of the facts. They therefore are able, apparently, to show 50 per cent. more watt-hours per pound of coal and 33⅓ per cent. less expense per kilowatt-hour output than another station operating under the same conditions and fully equaling theirs in actual performance, but which accepts the primary meter readings as the basis of estimate.

As a matter of fact, the usual disparity is greater than the percentages given, because most station managers, in erecting primary switchboard meters, follow their æsthetic inclinations, and use ornamental glass covers, which are particularly susceptible to the admission of dust and grit, with the result that the meters rapidly slow down. It is highly probable therefore that in some stations the volt-ampere hour record would show twice the number of apparent watt-hours per pound of coal, and one-half the expense per apparent kilowatt-hour output that would be shown by the record of the primary meter already erected on the switchboard, which tends only to show the worthlessness of data from different plants, for purposes of comparison, unless the local conditions are known in each case.

This digression is permissible, we hope, because the average power factor, so far as we know, has never been taken into account, and because for that reason much misleading alternating central-station data is in circulation.

Purchasers and users of transformers should insist that transformers meet certain requirements, or be rejected, and some of these requirements will be stated.

Where transformers are used for feeding networks, the secondaries in multiple, small core losses are of much greater importance than close regulation, and should be kept at the lowest practicable point. The regulation will be cared for by treating the transformer and feeder drop together, through the use of secondary pressure wires.

Where the transformers are entirely independent, feeding separate secondaries, close regulation must be had and the core losses be made as low as the adopted regulation will permit. With constant full load the temperature must not rise to a high point, and should not exceed 50° Centigrade above the surrounding air. This is important, not only because of the increased life of transformer insulation through low temperatures, but also, and possibly to a greater degree, because magnetic fatigue is a certain follower of high-core temperatures. If therefore the core losses might be increased 50 per cent., or possibly 100 per cent. through high temperatures, the cost of these core losses, as shown in the case of the plant above, make argument unnecessary as to the desirability of having transformers run cool.

The transformer case should be filled with oil, because of its insulating qualities, its exclusion of air and its assistance in maintaining the low temperature desired.

The insulation resistance between the primary and secondary windings should be able to stand up under not less than 10,000 volts, alternating, difference of potential, for transformers having 1,000-volt or 2,000-volt primaries, and the writer would strongly urge a 15,000-volt, alternating, test. If both the primary and secondary windings are on the core, the same insulation resistance should be required between either winding and the core as between the two windings. The use of grounded shields placed between the primary and the secondary windings, the grounding of the shell or core, the grounding of the secondaries, the placing in each customer's service connections of any device to automatically open the circuit of each customer in case of an unusual difference of potential, are all practices that are opposed as expensive, as liable to cause rather than prevent trouble, as complicating existing practice and as wholly unnecessary.

Proper insulation is sufficient protection against the damages sought to be avoided. Station managers as earnestly desire complete safety for life and property as the Underwriters' association, but vigorously oppose the introduction of any unnecessary devices that are expensive to install and to maintain. That association, in seeking protection for the secondaries, should do so through sufficient transformer insulation and low temperatures. Both of these requirements mean increased cost of production and higher selling prices, but as the consequent increased economy makes the increased cost a profitable investment, no reasonable manager will object. In this way the ends sought will be best attained, and the interests of all parties duly safeguarded.

Electrical Horse-grooming Machinery.

The electric motor is considered a necessary adjunct in many well-appointed modern stables, and horses are now groomed and clipped by electricity with "neatness and dispatch." The advantages of the application of the electric motor to grooming and clipping machines were early realized by the American Shearer Manufacturing company of Nashua, N. H., and its efforts toward supplying a demand for electrically driven groomers and clippers have met with considerable success. Hitherto, however, it has supplied merely the machinery exclusive of the motor, but owing to a demand which has arisen for complete grooming and clipping installations, it is now supplying the motor as well. In doing this, however, it has found it is necessary to simplify in a large measure the driving mechanism.

Fig. 1 shows a grooming and clipping machine driven by a bipolar motor through double countershafting with conical and idle pulleys. This method, while it allows of the operation of two or more groomers and clippers from one motor, was by no means satisfactory, on account of the complication of belts and pulleys necessary, and when it became a question of furnishing both driving and operating machinery it was felt that some more direct method of drive was needed. This was found in the small power moderate-speed motors developed by the General Electric company. These motors may be run in any position, either attached to the wall, set on a bracket or hung from the ceiling, and have been found peculiarly adapted to drive the groomers and clippers of the American Shearer Manufacturing company.

Fig 2 shows a grooming machine complete, with a one horse power motor and automatic starting rheostat. In this case no floor space is occupied by the motor, the countershafting is eliminated, and the belting is reduced to a single belt from the motor pulley to the pulley attached to the flexible shaft of the groomer and clipper. The motor is fastened to the ceiling beams in an inverted position, and the counterpoise or balance arm is attached to a swivel on the motor case. The automatic starting box, also fastened to the ceiling, is of the reversing type, with the contact arms pulled in either direction by leather straps. This clipping and grooming outfit is singularly compact and simple, and requires almost no attention beyond an occasional oiling. In ordering, it is simply necessary to state the nature and voltage of the current, and, if alternating, the phase and number of alternations. With the electric motor-driven groomer and clipper a horse may be thoroughly brushed in about 2½ minutes and clipped in about 35 minutes.

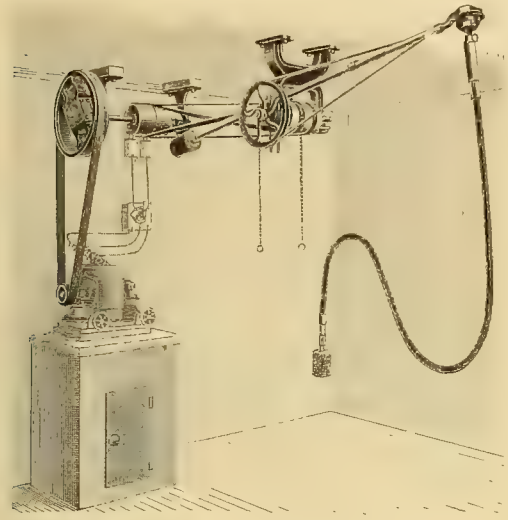


Fig. 1. Old Method of Drive Through Double Countershaft.

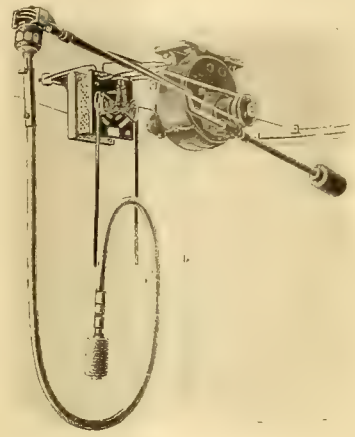


Fig. 2. New Method of Direct Drive.

ELECTRICAL HORSE-GROOMING MACHINERY.

An Interesting Factory Building.

A glance at the exterior of the new factory of the Veeder Manufacturing company of Hartford, Conn., (Fig. 1) shows that it is well lighted. The Veeder company manufactures cyclometers, and an abundance of light is needed in the processes of manufacture. The new building was designed by the Berlin Iron Bridge company of East Berlin, Conn., and it possesses several interesting features. The supporting framework is entirely of steel, the greater portion of the construction being steel and glass. The factory is three stories in height, the exterior presenting a striking appearance, from the unique character of the construction. It is 30 feet in width, 110 feet in length, the three floors giving nearly 10,000 square feet of floor surface, every inch of which, owing to the well-diffused light in the interior of the building, can be occupied for manufacturing purposes.

Fig. 2 gives an interior view. The photograph was taken on the second floor, and it shows the supporting girders of the third floor above and the truss work forming the supporting girders for the sides of the building. The interior is heated by hot air forced into the building from an adjoining boiler room by means of ducts located and made a part of the supporting columns of the building. This peculiar feature of the building was designed by C. H. Veeder, the president of the company, and adopted by the Berlin Iron Bridge company in its design. A hot-air outlet is shown on the second column in Fig. 2.

Particular attention is called to the sides of the building, which are made almost entirely of glass, but arranged in sections, so that they can be easily opened and closed, thus securing plenty of fresh air. Many people have an idea that if the sides of a building are made of glass the interior in warm weather must be insufferably hot, the same as a greenhouse. With proper construction the facts of the case are exactly opposite. Owing to the superior ventilation secured by means of every other panel of the glass swinging on a center pivot (Fig. 2), perfect ventilation may be secured, and thus, instead of being exceedingly hot in warm weather, it is unusually cool, and pure, clean air from the outside is furnished for the workmen.

Alternating current for power and lighting in the Veeder factory is obtained from the local electric light and power company at the pressure of 220 volts and in two phases. The 110-volt lamps are distributed by the ordinary three-wire system, the number on each phase being about equal. The power is utilized by General Electric two-phase induction motors. A five-horse specially wound motor is used to run the elevator, the motor being directly belted to the hoisting mechanism and reversed by a special switch. In order to avoid excessive currents in the armature winding when starting, the end connections in the armature winding are made of high-resistance metal. Some trouble was found at first on account of the excessive momentum of the armature, but a flange pulley was placed on the armature shaft and the belt allowed to run sufficiently loose so that the belt can slip on the armature pulley when the hoisting mechanism is stopped quickly. This arrangement has been in use several months and gives no trouble.

The tool room and machine shop are driven by a five horse power motor with standard winding, and the finishing room is driven by a three horse power motor. The motors have proved to be very satisfactory, running steadily and requiring little care.

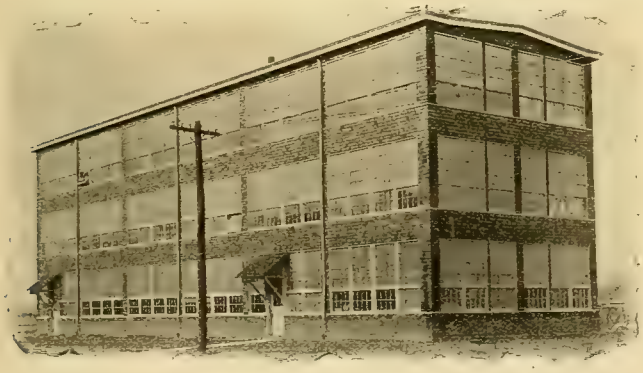


Fig. 1.

Fig. 2.

AN INTERESTING FACTORY BUILDING.

Transformer Economy.[1]

By Winder Elwell Goldsborough.

Part I.

A great deal has been said and written about the static transformer of alternating currents, and yet we are only just beginning to understand this much-discussed piece of apparatus. The manufacturers have made it and experimented with it, the theorists have experimented with it and disputed over it, the underwriters have disputed over it and endured it, and the central-station men have endured it and made use of it to the great good and comfort of the public. No other piece of apparatus in the field of electrical engineering has been lauded higher or been the subject of greater abuse, and to all it has served a purpose.

To-day the transformer occupies a higher position than ever before, and it grows in importance as each new development in the field of applied electricity points out a new department of usefulness for it.

There has, however, been enough agitation lately on the part of manufacturers, in behalf of substituting new types of transformers for the old ones now in use, and of relegating the small transformer to the scrap heap, to cause the central-station men, who are responsible for the successful operation of alternating-current generating plants, some unrest. The foundations of many of these plants were laid before the time of skilled designers of electrical machinery, and at a period when the factory motto was "cut and try." As the public demands increased, the plants developed and expanded before the practical men were amenable to "theories," and before the exact methods of the laboratory had become the daily practice of the constructing engineer. Managers see that engineers are still making mistakes, and that faulty design is still a factor in electrical development, and when they call to mind the enormous sums of money that have been spent in this country on ill-advised improvements, it is not to be wondered at that they hesitate.

There is, however, a gradual change for the better in the number of the yearly contributions to the records of our electrical societies, and as these records are the expression of the best thoughts of the men who have made America famous as the land of electricity, they may be taken as signs of the times in our department of engineering activity.

We are constantly impressed with the fact that the refinements of exact scientific methods are being made the subject of every-day discussion, and that the more difficult problems of the technical side of the profession are being so well elucidated by our "practical theorists" that it is possible for all of us to enjoy a concrete appreciation of electrical science without an excessive expenditure of mental energy on the theoretical.

We are coming to a time when exact methods will be the universal rule, and when the reputation of having a high "guessing factor" will no longer be a sufficient recommendation.

These influences are noticeable in the improved electrical intelligence of our workmen, as well as of our station engineers, and I find that it extends even to the general public. Indeed, a careful record of the number of times that I am asked "How

1. Read before the National Electric Light association, at Chicago, June 9, 1898.

does the little trolley wheel push the car along?" shows a yearly decrease of nearly 50 per cent.

So we see that matters adjudged to be of slight importance a few years ago are being allotted their normal position. A fault is a fault at the present day, and is not often disregarded as "too small to be appreciable." The old saying that "if you take care of the pennies, the dollars will take care of themselves" applies just as well to electrical engineering as it does to other professions, and it is the "pennies" that I am about to deal with.

Our principal manufacturing companies freely advertise and guarantee the specific economic performance of which each and every one of the transformers that they place upon the market is capable. They severally advertise to supply us with transformers equaling in efficiency, regulation (and what not), any other transformer that can be found upon the market.

The manufacturing companies are unanimous in their guarantees of high efficiency, low core losses, negligible ageing and close regulation. If we can purchase transformers freely on these representations, with sufficient guarantee that the specifications advertised are strictly conformed to or improved upon, there is little to be desired on the part of the purchaser over and above what is offered. Any slight improvement that it shall be possible to make upon the best of the performances advertised by the competing factories will be forthcoming in consequence of the rivalries of trade, and the purchaser need only seek now for means of protecting himself against occasional faulty manufacture.

When, therefore, we consider the perfection to which this type of apparatus has been brought, in its every detail, and in sizes varying in capacity from a fraction of one to over 800 kilowatts, we have cause for congratulation.

If you have followed the design and manufacture of the commercial transformer, I think you will admit that at the present time the best of them are figured just about as close as is possible, and in fact we have almost reached the point beyond which any further advance in the direction of improved efficiency must be made by getting better insulating materials, requiring less space and giving this space to the iron and copper.

With a view to investigating the present status of the transformer and the ability of transformer manufacturers to meet in all cases the exacting specifications which they had laid down for themselves, I have had a number of transformers of recent design tested in the Purdue laboratories within the last year. The results of these tests are especially gratifying when gauged from the standpoint of our present commercial requirements, and to the specialist a detailed statement of the results would be interesting. In view of the fact, however, that the electrical literature of the day contains much matter of this kind, I will not bore you with many figures, but rather discuss the results in a general way.

With but one exception the transformers tested have surpassed the requirements of the specifications laid down by Professor Jackson in his excellent article on transformer testing, with which we are all familiar, and generally speaking, they have conformed fairly closely to the published guarantees of the companies submitting the transformers for test. To what extent this is true may be better appreciated if I cite one or two examples.

A 2.5-kilowatt transformer was submitted for test that was guaranteed to conform to or improve upon the following specifications: Core loss, 48 watts; regulation, 2.1 per cent.; full load efficiency, 96.1 per cent. The test of this transformer gave core loss, 42.19 watts; regulation, 1.9 per cent.; full load efficiency, 96.2 per cent.

The showing made by this transformer is good. The core loss is 5.81 watts less than the stipulated value, and the efficiencies are in excess of the stipulated values. In this case the manufacturers more than substantiated their guarantee, and supplied a transformer that is a greater revenue producer than the specifications call for. If the core iron of this transformer can be relied upon as not materially increasing in its hysteretic loss with age, it is an easy matter to figure the money value of the excess economy that the transformer develops.

Suppose, for instance, a contract should be made for 40 of these transformers at $30 each to meet an increase in a station load of 100 kilowatts. On an all-day schedule these transformers would probably carry a commercial load equivalent to full load working for five hours. This assumption may seem to represent a better condition of service than is usually met with in practice, but it is an assumption that it is fair to the manufacturer in considering the all-day efficiency. The transformers would therefore be working under no load for 6,935 hours and under full load for 1,825 hours per year, and under the conditions of the test would save 1,794 kilowatt-hours to the station. If we figure the cost of producing this power at two cents per kilowatt-hour, the saving per year would be $35.88 for the 40 transformers, or practically three per cent. on the amount invested in the transformers. If this power were sold for six cents per kilowatt-hour it would represent a net gain to the purchaser of $1,794 \times .06 = \$107.64$ per year more than he had any right to expect under the contract specifications.

Another 2.5-kilowatt transformer submitted for test is advertised by the makers to show a core loss of 57 watts, a quarter-load efficiency of 91 per cent., a full-load efficiency of 96 per cent., a regulation of two per cent., and a no-load current of .1 ampere. Under test it was found to have a core loss of 63.6 watts, a quarter-load efficiency of 90 per cent., a full-load efficiency of 94.8, a regulation of three per cent. and no-load current of .087.

Suppose we estimate the economy of transformers of this type just as we did those of the type previously considered. The 40 transformers, working on the same schedule, would waste 4,014 kilowatt-hours more power than they should under the specifications advertised. At two cents per kilowatt-hour the total money loss would be $80 per year, or over 6.5 per cent. of the cost price of $1,200.

Many engineers may claim that the cost of checking up the performance of the transformers would more than eat up the saving effected by the small margin that these results represent, and in many cases under the present organization this would doubtless be true, but if a well-advised stand was taken by the central-station managers for mutual protection, the result would be markedly beneficial.

A percentage of the transformer output of each of the manufacturing firms could, for instance, be tested in some one place, where a record of the individual performance of all the transformers submitted for trial could be kept, and not only efficiency, but ageing and insulation and temperature trials could be made at a merely nominal expense.

But these examples do not cover the ground. I will cite two others.

In the case of a 15-kilowatt oil-insulated transformer, guaranteed to develop a quarter-load efficiency of 96 per cent., a full-load efficiency of 97.4 per cent. and to have a regulation of 1.77 per cent., the test showed a quarter-load efficiency of 94.5 per cent., a full-load efficiency of 96.1 per cent., and a regulation of 1.6 per cent. The core loss of this transformer, which operates at 60 cycles, is 186.6 watts, and the specifications under which it was built require that the core loss should be about 150 watts.

It would take seven of these to give an output of 100 kilowatts—and they would cost not less than $115 each. The seven transformers in this case would waste 3,855 kilowatt-hours in a year, which represents a financial loss of $77 in one year over and above the loss to be expected. This approximates 10 per cent. of the original cost of the transformers, and is an item that cannot be neglected.

If, on the other hand, this waste power could be sold at six cents per kilowatt-hour, it would represent a part of the just return on the investment contemplated when the transformers were purchased, and would mean $221 to the company.

I do not claim that the figures which I present to you cover all the items of expense that enter into the installation of 100 kilowatts in transformers. They do not, but they do represent a phase of the question that deserves more than passing attention at a time when competition is becoming sharper and sharper.

In what I have so far said I have not touched upon the matter of the ageing of the transformer core-iron. In cases where it is appreciable it only serves to aggravate the conditions and make the percentage loss greater. In the same way the cost of production and the selling price of the power both enter as important factors, as well as the cost of the transformers. All of these assumptions I have placed low, and they should be regarded rather as pertinent examples of the conditions that exist in large plants. The small plants will be affected by influences of this character to a much greater extent.

CORRESPONDENCE.

New York Notes.

New York, July 11.—On Friday the commissioner of bridges had a private conference with the representatives of the trolley lines which cross the Brooklyn Bridge. The object of the conference was to reach an agreement by which the expenses of the bridge would not exceed the income, as is the case at present. Under the agreement entered into by the old trustees, the trolley companies pay five cents a car for each round trip. Mr. Shea, the commissioner, laid before the representatives of the trolley companies a proposition by which they should pay a lump sum to the city of $150,300, or, as an equivalent, a certain sum for each passenger carried. This would meet the deficit and enable the bridge commissioner to make up the losses now being incurred. No agreement was reached.

The refusal of Comptroller Coler to pay the bills of the Jamaica Electric Light company has resulted in the village of Jamaica being left in darkness. The company operates under a contract made prior to consolidation, and claims that there is due from the city $22,000 for lighting Jamaica streets. The legality of the contract has been disputed, and the company has tired of supplying light without pay. It is said that some residents of the village have hung lanterns outside their houses and others use bicycle and carriage lamps. Those who have to remain out late carry a lantern for company.

The Metropolitan Street Railway company has made its annual application for a reduction of the amount at which its personal property, and that of the lines leased and owned by the company, has been assessed by the Board of Taxes and Assessments of the city of New York. John T. Little, Jr., of counsel for the Metropolitan company, obtained writs of certiorari from Justice Daly in the Supreme Court, for the purpose of having the decision of the tax commissioners reviewed. Mr. Little complained that the commissioners had assessed the various companies in January last the full amount of their capital stock. He said that he did not oppose this assessment on the real property of the corporation, but the assessments on the personal property of the company, although they had been reduced, were still too high.

Mr. Meade, one of the Police Court magistrates, has a great scorn for the street-railway service of the metropolis. An inspector of the Fourth avenue electric line appeared in the Tombs Police Court to press a charge against two boys accused of stealing rides on the cars of the lines. "What is the charge against these boys?" asked Magistrate Meade. "Stealing rides and annoying passengers," answered the policeman who made the arrest. "Annoying the passengers!" shouted the magistrate, looking at Inspector Orson. "No one can annoy the passengers so much as the conductors on the cars! When you try to stop a car they run by you at full speed and then turn and jeer at you. The conductors themselves down at the bridge don't know whether they are on a Fourth or a Second avenue car. It's the worst operated system in the world, and wouldn't be permitted for an hour anywhere else. The prisoners are discharged."

One good piece of news is the statement that in all probability the rapid-transit controvery has been shelved until fall. The Manhattan company's committee has Mr. Orr's latest communication, referred to in this correspondence last week, under consideration, but it is said that the Rapid Transit commissioners need expect no adequate answer to their letter from Mr. Gould until some time in September. At present there is only one really pertinent point of variance between the two bodies. That is the matter of the rental. Mr. Gould and his colleagues are determined that they will not pay five per cent. of gross receipts for the West street franchise, and, on their part, the Rapid Transit commissioners are as firmly convinced that any less compensation would be unfair and inequitable to the city. Mr. Gould and his colleagues are said to hope much from the next state election. Should the Democratic party be successful, efforts will be made immediately to remove the existing commission, and to institute a board which will be more in accord with Mr. Gould's feeling that the source of better transit facilities in New York should be found in an extension of the elevated railroads. Mr. Gould has sailed for Europe, and it is improbable that any further meeting of the extension committee will be held until his return, two months hence. M. S.

Northwestern Notations.

Minneapolis, July 11.—The Electric Light company of Mapleton, Minn., has enlarged its power station and will probably put in a new dynamo.

Alexander Hughes and Edmond A. Hughes of Bismarck, N. D., have been granted a franchise at Fargo, N. D., for an electric-light and power plant.

The Electric Light and Power company and the city of Maquoketa, Ia., have finally got together on the terms of a franchise, and the company has accepted the one passed by the council.

Allan Tompkins of Devils Lake, N. D., contemplates constructing an electric railway line to the Chautauqua grounds next season.

The Twin City Rapid Transit company has absorbed the North St. Paul White Bear and Suburban electric line, and it is rumored that it may extend it to Stillwater, Minn., another season.

F. H. Libbey is an applicant at Oshkosh, Wis., for an electric-light plant.

The Water and Light company of West Superior, Wis., made a new proposition to the city to furnish street lighting at a scale ranging from $100 per annum for 150 lights to $90 per annum for 300 lights, and to make reductions in the rates for commercial lighting. E. G. Mills made a proposition to erect an electric-light plant to furnish 150 lights, for an aggregate cost the first year of $8,460.

All bids for furnishing an electric-light plant for the city hospital in St. Paul were rejected and new bids were ordered.

The Chippewa Valley Electric Railway company is pushing work on its line in Chippewa Falls, Wis., and it is thought will be able to complete it within the time required by the franchise. It is announced that work will be begun on the interurban line to Eau Claire, and it is to be completed by August 1st.

The Ottumwa Electric and Steam company is the name of the reorganized company at Ottumwa, Ia., which takes the electric-light and street-car system. A number of improvements will be made to the street-railway line.

The Denison, Ia., Electric Light and Power company has added a new dynamo, which greatly improves its service.

The village of Hibbing, Minn., has contracted with the General Electric company for a 1,200-light incandescent dynamo and will add it to the plant.

The council of Story City, Ia., is canvassing the city with a view to putting in an electric-light plant. The outlook is that there will be enough business to warrant putting in a plant.

The council of West Superior, Wis., has accepted a proposition of the Water, Light and Power company for a five years' lighting contract, at $100 per

light per annum, for 150 lights. There is a reduction of 40 per cent. in general lighting.

William F. Stockmann, manager of the Western Union Telegraph company's office at Fort Madison, Ia., was married on June 15th to Miss Edith Hatton at Roseland, La.

The council of Fargo, N. D., granted a franchise to General Hughes of Bismarck, N. D., for an electric-light plant, which the mayor vetoed. The council passed it over the veto, and General Hughes is preparing to put in the plant in 10 weeks.

The Great Northern Railway company has begun work on an electric power house at West Superior, Wis., to furnish power for elevators A and X, instead of steam power.

The contracts are let for erecting the power house for the electric-light plant in Algona, Ia. Mr. Bigelow of Lincoln, Neb., will furnish the equipment, for about $12,000.

Winnebago City, Minn., voted $8,000 bonds for the establishment of an electric-light system. The council will take steps at once to install the plant, and it is expected to have it in operation by October 1st.

The council of Two Harbors, Minn., has been petitioned to call an election to vote on bonds for $8,000 for an electric-light plant.

President L. Mendenhall, on the application of Thomas Lowry of Minneapolis, has been appointed receiver for the Duluth Street Railway company. It is explained that this is the beginning of the reorganization made necessary by an excessive capitalization and shrinkage in western business and values since 1893. C.

PERSONAL.

H. L. Doherty, manager of the Madison Gas and Electric company of Madison, Wis., was in Chicago on Monday.

Ludwig Gutmann, the chief electrician of the Royal Electric company of Peoria, is spending his vacation in and about Chicago.

Dr. Elisha Gray is recasting his interesting articles in the Chicago Times-Herald, entitled "Short Talks on Science," and will soon bring them out in book form.

President McKinley has appointed as the commissioners to revise the patent laws Judge P. S. Grosscup of Illinois, Francis Forbes of New York and Arthur P. Greeley of New Hampshire.

Channing T. Gage has taken charge of the Washburn & Moen Manufacturing company's office at St. Paul, Minn. He reports that business is excellent in his territory. Mr. Gage's headquarters in St. Paul are at 401 Manhattan building.

Mr. William S. Brayton of the New York office of the General Electric company was recently married to Miss Alice Wait of Ithaca. Mr. Brayton is a graduate of Cornell and passed through the works at Schenectady before assuming his duties at the New York office. He is a favorite among all his associates, who testified their appreciation by presenting him a handsome souvenir of their esteem.

Mr. Romeo Tagliabue of 804 South Tryon street, Charlotte, N. C., writes to the Western Electrician apropos of a recent article on "The Italian Market as an Outlet for Electrical Machinery," expressing his willingness to act as general agent for American electrical manufacturers in some Italian center, such as Milan. He is a native of that city, and has traveled in Italy for a number of years, but states that he has been trained as a practical electrician in the United States.

ELECTRIC LIGHTING.

A fire at Whatcom, Wash., on June 27th destroyed the electric-light plant.

The Los Angeles Electric company has, it is said, offered to furnish the city 2,000 candle power arc lights for the streets on an all-night schedule for $78 a year each.

M. C. Thye, formerly city electrician of Los Angeles, Cal., offers to erect an electric-light plant for that city for the sum of $129,312. The capacity of the proposed plant is not stated in the newspaper report.

Two judgments, aggregating $20,891.52, were confessed last week in Judge Clifford's court, Chicago, by the Hyde Park Electric Light and Power company, which furnishes illumination for residents of Grand Crossing from its plant at 7248 South Chicago avenue. No levy was made on the company's property. The judgments were on a note for $14,891.52 held by Clarence N. Goodwin, and one in favor of Robert F. Hall for $6,000.

The old contention of overhead or underground wires for the transmission of electricity in the District of Columbia is again up for discussion, this time through a bill introduced by Senator Gallinger for the purpose of opening up conduits to take the overhead electric-light wires at present or to be in the future used in the city of Washington. The bill provides for necessary extensions of the two electric-light companies' lines and that all transpositions from overhead wires to conduits must be completed before October 1, 1899.

A. L. Stokoe is completing some improvements in the arrangement and equipment of his electric light plant at Jeanerette, La. He has a 25-year franchise and a seven-year contract for street lighting. Twenty-eight 32 candle power incandescent street lights are already in operation, and more will be added. Electric lights are also used in the principal establishments of the town. The plant lacks nothing in completeness, and has a capacity of 300 lights. A 220-volt Eddy dynamo driven by a Westinghouse engine furnishes current.

The People's Light and Power company of Jersey City, N. J., is erecting a new boiler house in connection with its electric plant. The building is a modern structure in every respect. It is 60 feet wide and about 90 feet long and contains ample space for large upright boilers, and has an arrangement for the storage of coal in the steel bunker inside the building, so that the fuel can be easily taken direct to the boilers. The tracks are arranged so that railroad cars will run into the building and discharge the coal directly into the bunker. The building is of fireproof construction throughout, with steel frame, brick side walls, and iron roof covering, well lighted and ventilated. The steel work is being furnished and erected by the Berlin Iron Bridge company of East Berlin, Conn. Sandford & Stillman of Jersey City have the contract for the building.

The new electric-lighting plant of the Ventura (Cal.) Land and Power company is now completed. The city has been without incandescent electric lights since the destruction by fire of the old plant last January. The plant comprises a Babcock & Wilcox boiler, Hamilton-Corliss engine, Wood alternator and a series arc dynamo. At present the company has a large quantity of wood on hand which is being used for fuel. It expects to use oil in the future, but will not use steam power all the time. It is only doing so now by necessity, owing to the lack of water in the Ventura River. It is installing Pelton water wheels, and the necessary water for the running of the plant will be stored in a large reservoir about one mile above the plant. This storage reservoir will have a capacity of 3,000,000 gallons of water. The water will be stored by day and utilized by night. This plant will furnish electric power to the Santa Ana Water company. The water company has placed a five horse power motor and a 4 by 6 duplex pump at the pumping station, adjoining the reservoir in the eastern addition, which will be operated by power from the electric-light plant. This pump has a capacity of 5,000 gallons of water per hour. The power will be furnished at night. General Manager G. W. Chrisman deserves much credit for his prompt action in rebuilding the Ventura plant, after the company's heavy loss by fire.

ELECTRIC RAILWAYS.

The company owning the Niagara Falls and Lewiston electric road, the Gorge Route, has entered into a traffic arrangement with the New York Central company whereby passengers on either road may make the trip to or from Lewiston and Niagara Falls over whichever road they choose.

POWER TRANSMISSION.

The new plant of the San Gabriel Electric company of Los Angeles, Cal., was put in operation on June 23d.

The Ensenada (Mexico) Lower Californian of June 18th says: "It is reported that a syndicate of Mexican capitalists has obtained a concession to utilize for the generation of electric current 56 waterfalls. The falls are said to represent an aggregate energy of 1,331,325 horse power."

At Oakland, Cal., application has been made to the supervisors for the franchise for the erection of poles and wires to transmit electrical power to that city from Blue Lakes, Amador County. It is proposed to supply power to all the cities within a radius of several hundred miles from San Francisco. The application is made in the name of T. C. Bullock, for the Standard Electric company. The company has its right-of-way and franchise secured through Amador, Calaveras, San Joaquin and Contra Costa counties and over private lands as far as Lake Chabot.

ELECTRICAL SECURITIES.

The Citizens' Street Railway company of Indianapolis has extended its second-mortgage indebtedness to June of 1900. The amount of the indebtedness is $700,000.

The New England Telegraph and Telephone company has decided to increase its capital stock from $12,000,000 to $15,000,000, acting upon the advice of the board of directors.

Dividends have been declared by the Columbus Street Railway company of one per cent., payable August 1st, and by the Brooklyn City Railroad company of 2½ per cent., payable July 15th.

It is stated that the Metropolitan Elevated reorganization plan, soon to be announced, contemplates an issue of four per cent. bonds to the extent of 60 per cent. of the present mortgage, and preferred stock for the balance, together with the unpaid coupons. It is also proposed, it is said, to assess the common stock $4 per share. The Metropolitan has $15,000,000 in five per cent. bonds, 60 per cent. of which is $9,000,000. The interest charges on bonds under this plan would be reduced from $750,000 to $360,000, or more than half. The amount of preferred stock to be issued would be $6,000,000, plus the amount of unpaid interest. A $4 assessment on $15,000,000 stock would yield $600,000. Such a reorganization, it is estimated, would make the stock worth about 60.

A Boston dispatch announces that Samuel Carr, representative of the Ames estate, has resigned as a member of the General Electric preferred stockholders' committee and C. A. Coffin, president of the company, has been elected in his place. This assures the removal of all danger of litigation over the adjustment of General Electric's impairment of capital. The preferred stockholders will receive $1,500,000 in cash and funds remaining equal to six per cent. on the amount of reduced common stock.

TELEGRAPH.

Judge Grosscup has entered a final decree in the United States Circuit Court permanently enjoining Oscar M. Stone and the Independent Telegraph company of Chicago from tapping, using or in any way interfering with the wires or using news belonging to the Western Union Telegraph company. When the temporary injunction was in force it was alleged that Stone was seen tapping wires near Grant Junction, Ind.

MISCELLANEOUS.

It is announced that the General Electric company will make a large working exhibit at the twentieth triennial exhibition in the Mechanics building at Boston in October, conducted by the Massachusettes Charitable Mechanic association.

The celebration of the fiftieth anniversary of the American Association for the Advancement of Science will be held in Boston on August 22d to 27th, and the opening session will be held at 10 a. m. on Monday, August 22d, in Huntington Hall, Rogers building.

Georg Kirkegaard of 28 State street, New York, has issued a valuable "Machinists and Draughtsmen's Data Sheet." This sheet is intended to be tacked over a work bench or drawing board or in a tool chest, and gives at a glance much information that is often needed as to speeds, weights and dimensions of machinery and materials.

It is announced that La Compagnie Générale des Petites Voitures, which some time ago resolved upon the introduction of motor carriages, has decided to place 100 electric vehicles on the streets of Paris within the next two months. Each vehicle will seat four passengers, the fare remaining about the same as for the present two-seated cabs.

TRADE NEWS.

The Western Telephone Construction company is running its factory nights to fill some large orders, and its product for the month of July promises to be the largest in its history. This is an indication of prosperity which should dispel any question of continued success.

The Pelton Water Wheel company reports an active business at both its San Francisco and New York works. The war has affected to some extent its export trade; still this is, on the whole, very satisfactory. Electric power-transmission plants are still a prominent feature in the work of this company.

The Walker company, on account of rush of work and consequent need of additional space, has found it necessary to add to the large machine shops it already possesses at the Cleveland works. These machine shops alone consist of three bays, each 400 feet long, and the addition will consist of a fourth bay. Work is being rapidly pushed, and the new bay will be shortly completed and ready to receive the large machine tools which are to be placed there.

BUSINESS.

Customers of the Columbia Incandescent Lamp company of St. Louis are notified that the factory will be closed during August for additions and improvements.

The Western Electric company has recently mailed to the trade a copy of its tool catalogue No. 3. If any reader of the Western Electrician failed to receive a copy, one will be sent upon application.

The Central Electric company of Chicago is carrying in stock large quantities of wooden and iron pins, brackets and glass insulators. It has considerably augmented its previously large stocks, and is prepared to take orders of any size.

The Buckeye Electric company, through its western representative, J. H. Cooke, 753 Monadnock building, Chicago, reports large sales of the Buckeye special coiled-filament lamp during the month of June. Tests of the Buckeye lamp made recently by a large number of lighting plants show, it is stated, that the wattage, voltage and candle

power of the lamp are maintained within remarkably close range. Special annual contract rates are being made.

The Detroit and Cleveland Navigation company, "the Coast Line to Mackinac," offers 1,000 miles of lake ride on modern steel steamers at low rates. A. A. Schantz, the general passenger agent at Detroit, will send an illustrated pamphlet for two cents.

A handsome catalogue, with a cover of curiously mottled paper, describes the well-known automatic cut-off engines of the Ball Engine company of Erie, Pa. These engines have an excellent reputation among electrical men and are largely used in electric-lighting plants, where good regulation is, of course, essential. The distinguishing features of the engine are clearly described in the new catalogue, and good half-tones show parts and types of machines.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 5, 1898.

606,646. Rheostat. Henry B. Cutter, Philadelphia, Pa. Application filed June 22, 1897.

The automatic magnetic circuit breaker is adjustable with respect to the flow of current necessary for its actuation, and means of preventing the closing of the circuit-breaker when the rheostat arm is in certain positions, are described.

606,663. Electric Railway. John C. Henry, Denver, Colo. Application filed March 28, 1898.

The method of changing the two motors of a car equipment from series to parallel relation consists in short-circuiting the field magnet of one of the motors, subsequently short-circuiting the armature of the motor, breaking the series connection and closing a connection placing the armatures in parallel, and breaking the short-circuit through its field magnet.

606,664. Electric Railway. John C. Henry, Denver, Colo. Application filed April 7, 1898.

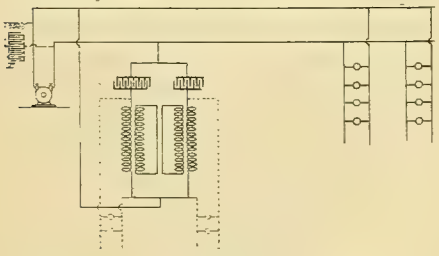
The method of controlling electric motors whose field magnets are in a circuit independent of their armatures consists of decreasing the resistance of the field-magnet circuit of one motor so as to increase the energization of the field magnet of the other motor and correspondingly decrease the armature current of the other motor.

606,746. Electric-light Switch. Frederic L. Temple, St. John, Canada. Application filed October 7, 1897.

The shears-like levers have their upper portions or jaws adapted to readily receive between them the inner end of the door key, and the spring-metal electric conductors, with their lower ends adapted to be connected to electric wires, have upper-end engaging contact points, the levers also having insulated projections or studs adapted to engage the spring conductors and hold the contact points in engagement with the aid of the door key.

606,761. Method of and Apparatus for Generating Alternating Currents. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed March 13, 1894. Patented in France October 8, 1891; in Germany October 30, 1891, and in Austria October 23, 1892.

A generator of alternating currents is provided with an exciting circuit or circuits, and means for maintaining oscillatory electrical discharges in the same.



NO. 606,761.

606,762. Alternating-current Dynamo. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed April 19, 1895. Patented in France June 13, 1894; in Germany June 26, 1894; in Austria July 4, 1894; in Hungary July 14, 1894; in Belgium November 9, 1894; in Switzerland November 9, 1894; in England November 12, 1894; in Italy November 12, 1894, and in Spain November 12, 1894.

The method of generating alternating electric currents consists in producing periodically alternating magnetic poles, fixed with reference to a field magnet, reinforcing the same by the movement of a closed circuit or circuits with reference and in inductive relation thereto, and inducing by the reinforced field or fields alternating currents, in a circuit or circuits traversing the reinforced fields.

606,764. Telephone Exchange. Frank A. Lundquist, Chicago, Ill. Application filed May 19, 1897.

A contact-closing device is described, consisting of a crank, a pitman connected thereto, an electrical connection with which the pitman makes a contact once during each revolution of the crank, a device connected to the crank and adapted to draw it to and hold it at a position where the pitman will not be in electrical contact, and connections between the crank and a crank-arm for permitting the first-mentioned crank to be turned by hand.

606,792. Electric Radiator. Frederick W. Quidas, Mount Washington, Md. Application filed July 22, 1897.

A car heater is described comprising a casing having a partially cylindrical back, a resistance inclosed in the casing, a reflector in the rear of the resistance and inside the casing, and a block of poor heat-conducting material in which the casing is partially embedded, leaving its front mainly exposed.

606,795. Electric Meter. William Stanley, Pittsfield, and Frederick Darlington, Great Barrington, Mass. Application filed January 13, 1898.

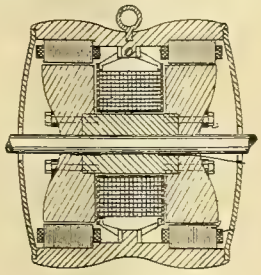
Means for supporting a rotating body are provided consisting of a permanent magnetic system having polar portions with recesses therein, a cylindrical shaft having its lower end projecting a considerable distance into the lower polar portions of the system, and the body of its upper portion being substantially at the mouth of the upper recess, and means for holding the ends of the shaft concentric with the recesses.

606,803. Telephone System. Burton R. Dodge, Post Mill Village, Vt. Application filed June 17, 1897.

A party-line telephone system having two metallic main leads and a plurality of stations, each station having a talking circuit, a signaling circuit and a telephone switch alternately closing the circuits, the signaling circuit comprising a signal bell, a generator and a resistance, the resistance being in parallel with the generator and in series with the bell, and the signaling circuit also comprising a switch for normally holding the resistance in the closed circuit and capable of throwing the bell in such circuit to the exclusion of the resistance.

606,819. Contact Device for Electrically Propelled Vehicles. Harry P. Davis, Pittsburg, Pa. Application filed April 6, 1896. Renewed March 16, 1897.

A reversible support for electric-railway contact devices is supplied in combination with automatically operated means for locking the support in either of two positions and means connected with the contact device for unlocking the support.



NO. 606,863.

606,825. Contact Device for Electric Railways. Charles A. Terry, New York, N. Y., and Harry P. Davis, Pittsburg, Pa. Application filed March 2, 1896.

This contact device consists of a revolving cylinder or roller, a fork carrying the same, stationary pieces at the end of the roller constituting continuations thereof and tapering outwardly, and a supporting arm rigidly joined at its upper end directly to the fork.

606,826. Current-collecting Apparatus for Electric Railways. Charles A. Terry, New York, N. Y., and Harry P. Davis, Pittsburg, Pa. Application filed April 6, 1896.

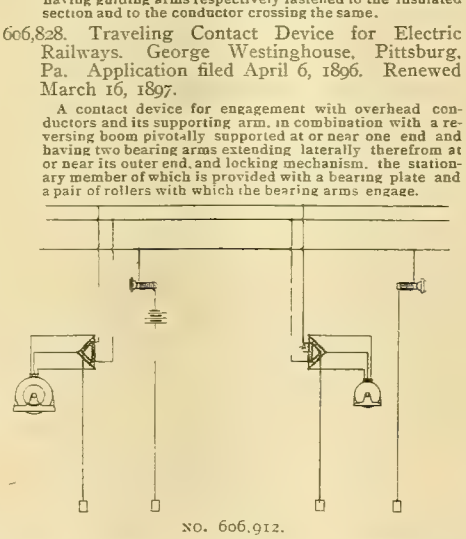
The contact supporting arm and a pivoted base to which the arm is hinged, a locking device normally acting to hold the base against movement on its pivot, and means actuated by the downward movement of the arm to unlock the base are claimed.

606,827. Overhead Construction for Electric Railways. Charles A. Terry, New York, N. Y., and Harry P. Davis, Pittsburg, Pa. Application filed June 10, 1896.

An overhead supply conductor for electric railways having a section insulated from the main portion, an auxiliary section bridging the insulated section, a second supply conductor crossing the insulated section and a casting having guiding arms respectively fastened to the insulated section and to the conductor crossing the same.

606,828. Traveling Contact Device for Electric Railways. George Westinghouse, Pittsburg, Pa. Application filed April 6, 1896. Renewed March 16, 1897.

A contact device for engagement with overhead conductors and its supporting arm, in combination with a reversing boom pivotally supported at or near one end and having two bearing arms extending laterally therefrom at or near its outer end, and locking mechanism, the stationary member of which is provided with a bearing plate and a pair of rollers with which the bearing arms engage.



NO. 606,912.

606,830. Insulator. Ben Willard, Schenectady, N. Y. Application filed April 18, 1898.

Claim is made for the combination with a body of insulating material of a metal cap, free to move up and down on the insulating material, supporting the conductor, and means for preventing the cap from turning on the insulating material, and means for securing the insulating material to a support.

606,852. Telephonic Transmitter. Thomas F. Ahern, Detroit, Mich. Application filed June 19, 1897.

An electric telephone transmitter consists of two substantially triangular carbon electrodes placed in frictional contact, the area of which is varied by the sound vibrations of the diaphragm carrying one of the electrodes

606,863. Alternating-current Dynamo. Ludwig Gutmann, Peoria, Ill. Application filed December 4, 1897.

The essential features include the combination of a rotary field magnet core of solid magnetic material, having outwardly projecting poles, an energizing coil securely held between the polar projections, a stationary magnetic annulus having inwardly extending polar projections, alternate ones corresponding with those of the field magnet, stationary induced coils mounted on the inwardly extending projections and means for removing parts of the field magnet core.

606,884. Electric Snap Switch. Alfred F. Wood, Philadelphia, Pa. Application filed October 8, 1897.

This device consists of a suitable casing, a disk journaled therein, a lever pivoted concentric with the disk, a spring connected between the disk and the lever, two dogs pivoted to the lever, a locking plate with which the noses of the dogs are adapted to engage, a spring drawing the dogs together and means for oscillating the disk.

606,887. Electric Extraction of Poisons. John B. Campbell, Cincinnati, Ohio. Application filed October 5, 1896.

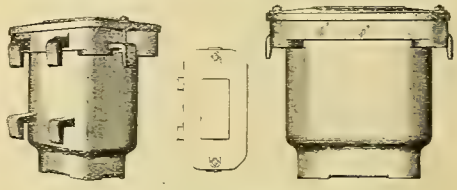
The method described of extracting poisons from the human body consists in providing the negative electrode of an electric battery with interchangeable receivers of animal, vegetable or mineral substance, to extract a poison from the body of a nature or kind corresponding with or to the negative electrode employed.

606,912. Means for Preventing Disturbances in Telephonic Circuits. Otto T. Blathy and Koloman de Kandó, Budapest, Austria-Hungary. Application filed April 27, 1897.

Monophase or polyphase alternating-current plants which have one of the conductors grounded, with alternating currents of a frequency less than twenty complete periods per second, in combination with monophase or polyphase alternating-current motors with slantwise slots, for preventing disturbing influence on telephone apparatus.

606,917. Electric Brake. Harry P. Davis, Pittsburg, Pa. Application filed October 22, 1897.

A plurality of electric motors for propelling vehicles and means for controlling their power and speed are combined with a plurality of brake magnets normally out of circuit, and means for establishing a local circuit containing a variable resistance and having a plurality of branches, each of which contains one of the motors and one of the brake magnets.



NO. 28,997.

606,939. Switch for Arc Lamps. Charles A. Pfluger, Chicago, Ill. Application filed December 21, 1896.

A switch for electric circuits, comprising four terminals divided into two pairs, an arm associated with each pair of terminals and adapted to connect the terminals of the respective pairs together, a conducting controlling arm located between the pairs of terminals and adapted to become part of the circuit at predetermined times, the controlling arm adapted to operatively engage the arms when in a predetermined position and move them both into and out of contact with their opposed terminals.

606,968. Permanent Way for Railways. Peter Hevner, Philadelphia, Pa. Application filed March 24, 1897. Renewed April 12, 1898.

Details of construction include the combination of the track rails, girders beneath the same, a conduit disposed between the rails and below the street surface and composed in part of opposite side walls and in part of a mass of concrete interposed between the rail girders and conduit walls, and extending beneath the latter to form the bottom of the conduit, and braces whereby both the upper and lower portions of each of the side walls of the conduit are confined laterally to the rail girders.

606,990. Electric Railway. John C. Henry, Denver, Colo. Application filed April 18, 1898.

The method of changing the armatures of a two-motor car equipment from series to parallel connection consists in closing a shunt around one of the armatures of such resistance as to substantially divert the line current from the armature without the production of a short-circuiting current through the armature.

606,991. Electric Railway. John C. Henry, Denver, Colo. Application filed April 25, 1898.

The combination with two electric motors having their field magnets and armatures in separate circuits and a controller for regulating the field magnets and armatures thereof, of a supplemental switch arranged to independently vary the resistance of the field-magnet circuit.

REISSUE.

11,676. Storage or Secondary Battery. Ralph Ashley, Port Republic, N. J. Application filed April 9, 1898. Original No. 594,313, dated November 23, 1897.

One claim is given: An electrode for a storage or other battery consisting of the horizontal, straight, and corrugated metal strips alternating with each other, and the spacing pieces between the ends thereof, and soldered thereto.

DESIGN.

28,997. Transformer Casing. James W. Packard and Henry W. Wiswell, Warren, Ohio. Application filed May 20, 1898.

The claim is for the design for a transformer casing shown.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO JULY 23, 1898. No. 4

Electric Service Plant at the Trans-Mississippi and International Exposition.

An important feature of the equipment of the Trans-Mississippi and International Exposition at Omaha is the electric-light and power plant which supplies current for the illumination of the grounds and buildings and the operation of motors in all parts of the exhibition. The power house occupies a point overlooking the river in the northeastern corner of the exposition grounds, where the smoke and dirt and heat do not mar the general appearance of the exposition picture and do not annoy the visitors. By this arrangement, too, the management has been able to secure an inexpensive plant, conveniently located for fuel and water, where no attention whatever was required for the appearance of the structure and little need be given the arrangement of the machinery, further than providing for the efficiency and reliability of the electrical service. The engineers in charge of the work, realizing the requirements and restrictions of the service, did not attempt to present an exhibition plant of modern design, and for the same reason they refrained from seeking the latest types of apparatus for the equipment; in fact, they confined their efforts to securing the essential features of service of this character, namely, efficiency, reliability and economy. It is not at all surprising, therefore, that the power house in some respects presents the appearance of a temporary plant, although upon closer examination it will be found that the apparatus and material employed are of standard type, and that everything about the plant and circuits has been carefully erected. Moreover, the details of the distribution system have been worked out with great care and skill.

The power house is a frame structure in two parts, one containing the boiler equipment and the other the engines, dynamos and switchboards. The distinguishing feature of the power house is the appearance of the six steel stacks which rise to a height of 140 feet above the boiler plant. Alongside of the building is a railroad siding upon which fuel and supplies may be brought in from all the railroads entering the city. The illustration (Fig. 5) on page 44 is an excellent exterior view of the power house, showing these characteristic features. It will be noticed, too, by reference to the tracing (Fig. 6) on page 46, that the power house is located at the turn in the Midway, which extends for a considerable distance along the eastern and northern ends of the exposition grounds.

The picture on this page, Fig. 1, presents a general view of the engine and dynamo room. The engines are arranged along the eastern end of the room in the following order, beginning at the north end, which is the farthest point in the view presented: Three Westinghouse of 375 horse power each, one Sioux-Corliss of 500 horse power, one Buffalo Forge of 200 horse power, one Imperial of 200 horse power and one Hamilton-Corliss of 250 horse power. The dynamos driven by these engines include two General Electric alternating machines of 180 and four of 120 kilowatts capacity, with six exciters, four 125-light Brush arc machines and one General Electric multipolar direct-current 500-volt power generator of 270 kilowatts. The switchboards are built up of General Electric standard marble panels, and provision is made for controlling from this point all the special lighting about the Grand Court, as well as the arc-lighting service, the illumination of the buildings and the power circuits.

FIG. 1. ELECTRIC SERVICE PLANT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—DYNAMO AND ENGINE ROOM.

In the boiler house there are six Morrin Climax boilers arranged in a row as shown in the picture (Fig. 2) on page 44. Four of these boilers, numbers 1, 2, 3 and 4, are of 600 horse power each, and two, numbers 5 and 6, have a capacity of 300 horse power each. The relative positions of the boilers, engines and dynamos are well shown in Fig. 3, which is here reproduced through courtesy of Power, as is also the diagram, Fig. 4. Fig. 3 shows a view from the opposite end of the power house from that shown in the photographs of the dynamo and boiler rooms reproduced in Figs. 1 and 2. An excellent idea of the arrangement of the plan can be gained from these views, supplemented by the diagram (Fig. 4). It will be noticed by reference to this drawing that a visitors' gallery occupies a middle position between the boiler and dynamo rooms, extending about halfway down the structure. There is a workshop at

the opposite end of the building where special fittings and repairs are made for the electrical department, and a forge occupies a small room in the northeastern corner of the power house. Three coal bins of large capacity are arranged behind the boilers and are conveniently located with reference to the railroad tracks, for unloading fuel from the cars. With this general description of the arrangement of the plant in mind, the reader will better understand the details of construction and equipment which follow.

The steam plant is substantially the same as that employed at the Nashville Exposition, the six boilers occupying a floor space of 100 by 25 feet. The four 600 horse power boilers are capable of evaporating 22,500 pounds of water per hour each, and the two 300 horse power boilers have a capacity of 15,000 pounds each. As already mentioned, they are of the Morrin Climax type, built by the Clonbrock Steam Boiler company of Brooklyn. The steam pipes are so arranged that one-half of the boilers may be run at one pressure and the other half at another. All the pipes and fittings are extra heavy to avoid any risk of their giving way. The boiler house is fitted with automatic steam-pressure recorders, high and low-water alarms and the latest auxiliary devices in this line. These boilers are fed by three steam pumps, one Marsh, one Gardner and one Worthington. The Marsh pump is made by the Battle Creek Steam Pump company of Battle Creek, Mich, and has proved particularly well adapted for this class of service.

The engine and dynamo equipment presents no new or especially interesting features. All the dynamos are run independently and are belt driven. Both engines and dynamos are numbered from left to right in the drawing (Fig. 4). Of the former Nos. 1, 2 and 3 are 18 by 30 by 16 compound Westinghouse non-condensing engines rated at 375 horse power each and running at 254 revolutions per minute. These engines are belted to three General Electric alternators, Nos. 1, 3 and 5, and four Brush arc machines, Nos. 2, 4, 6 and 7. One of the alternators (No. 1) has a capacity of 180 kilowatts and the others (Nos. 2 and 3) 120 kilowatts each. The Brush machines have a capacity of 83 horse power each and furnish current to 500 arc lamps. The central feature in the picture is the 24 by 48 Sioux-Corliss engine (No. 4), which occupies a prominent position half-way down the row of engines. This engine is particularly adapted for heavy work and was built by the Murray Iron Works of Burlington, Ia. It is rated at 500 horse power and runs at 80 revolutions per minute. The wheel is 18 feet in diameter and has a 37-inch face. It drives the big 350 horse power generator (No. 8) which furnishes current for the motors in the Machinery and Electricity building and for service throughout the exhibition. This generator is a multipolar, direct-current machine, wound for 500 volts and rated at 270 kilowatts. It was built by the General Electric company. Engine No. 5 is a 16 by 16 automatic cut-off engine made by the Buffalo Forge company. It is rated at 200 horse power running at 250 revolutions per minute. The special feature of this engine is the design of the bed. The engine frame has a narrow but deep channel on each side of the guides, allowing the oil to rapidly return to the crank pit, the bottom of which is considerably lower. A false head is placed on the inner side of the bed next to the guides, which prevents the oil from being thrown up against the hot cylinder head. After coming into contact with this plate, it returns through the same channels to the crank pit; thus the oil is kept cool and in good lubricating condition. A deep pocket is cut between the cylinder head and splasher plate, wherein any water from the piston is separated from oil accumulating at this point; the water may be drawn off and the oil returned to the bed if desired. A 160 horse power General Electric alternator (No. 9) is belted to this engine. A similar generator (No. 10) is driven by the 200 horse power Imperial engine (No. 6). This is a 16 by 16 engine made by the Weston Engine company, running at 250 revolutions per minute and rated at 200 horse power. The flywheels are 72 inches in diameter. The last equipment, comprising engine No. 7 and dynamo No. 11, is a Hamilton-Corliss single-cylinder heavy-duty 18 by 42 engine, built by the Hooven, Owens & Rentschler company, rated at 250 horse power, running at 100 revolutions per minute and driving a 240 horse power alternator made by the General Electric company. This engine has double eccentrics and disk cranks. The wheel is 14 feet in diameter and has a 20-inch face.

By this arrangement the two large alternators (Nos. 1 and 11) of 180 kilowatts each occupy positions at the extreme right and left, while the large power generator (No. 8) of 270 kilowatts, was placed about the center of the building. The intervening space is occupied by the smaller alternators (Nos. 3 and 5 at the left and 9 and 10 at the right), each of 120 kilowatts capacity, and the 125-light arc machines (Nos. 2, 4, 6 and 7) at the left.

Current from the power plant is distributed on series arc, single-phase alternating and 500-volt direct-current circuits. There are about 30,000 incandescent lamps and 500 arc lamps in actual use and 400 horse power is supplied for exhibition and demonstration purposes. In the distribution of current about the grounds and buildings 30 miles of overhead pole-line construction and 15 miles of wooden ducts are employed. In the plan of the grounds and buildings shown in Fig. 6 on page 46 it will be noticed that the circuits extend from the power house north and east to the Grand Court, where the principal demand for current exists. The straight lines in the drawing show the overhead circuits carried on poles, while the underground circuits are distinguished by broken lines. The center of distribution is directly in the rear of the Agricultural building, more than a mile away from the power house. It will be noticed that the underground work is confined principally to the vicinity of the Grand Court. Of course no overhead wires are permitted to mar the beauty of the picture presented by that grouping of buildings. It is worthy of mention that the underground cable used at the Omaha exposition had been used for similar service first at the World's Fair, next at Atlanta and again at Nashville before being put down at Omaha. This cable was furnished by the New York Safety Insulated Wire and Cable company, as was also most of the overhead wire. The latter had also been utilized at Nashville for exposition service.

FIG 5 ELECTRIC SERVICE PLANT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—VIEW OF POWER PLANT.

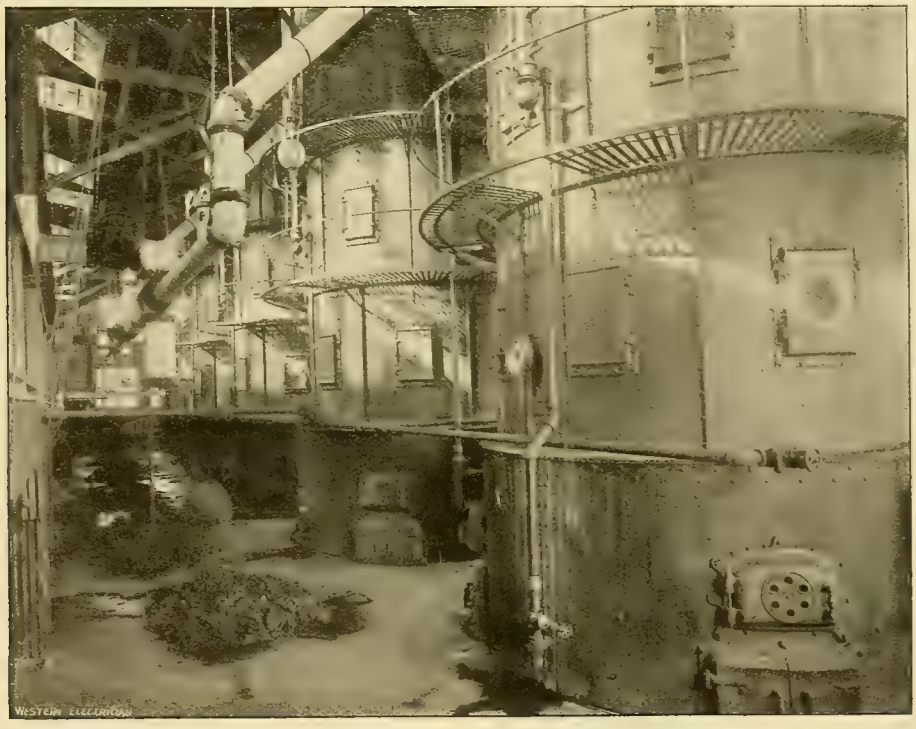


FIG. 2. ELECTRIC SERVICE PLANT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—BOILER ROOM.

The construction and operation of the light and power plant was intrusted to Mr. Henry Rustin, who is at present superintendent of the bureau, and he has proved a very efficient and painstaking officer. The selection proved appropriate as well as fortunate, as Mr. Rustin is a native of Omaha and has many friends in that city and throughout the state. He was born in 1865 and passed through the local schools, finishing at the Omaha high school. He was graduated from Phillips Academy at Andover, Mass., in 1883, and from Yale College in 1886. In 1888 he was in charge of electric construction of the Omaha Street Railway company, and in 1890 was assistant general superintendent of the Multnoma Street Railway company at Portland, Oregon. In 1892 he was appointed assistant general superintendent and elected a director of the Portland Consolidated Street Railway company. His experience was not confined to this class of work, however. He went to Hazleton, Pa., in 1894, to take charge of the Hazleton Manufacturing company and superintend the construction of the large factory then contemplated. When it was determined to hold the Trans-Mississippi and International Exposition at Omaha, Mr. Rustin became interested in the project and advocated a liberal policy for the electrical department, believing rightly that electrical features would contain more interest for the public than any other and prove more attractive. He was placed in charge of the electrical work in November, 1897, and has since been engaged in superintending the light and power bureau. Mr. Rustin's connection with the Omaha exhibition has been entirely satisfactory to himself and the management, and the latter has signified its approval of his work by passing a formal vote of thanks, which was published in the Western Electrician on July 9th.

Detroit's Public Lighting.

[Special Correspondence of the Western Electrician.]

Detroit, July 14.—In his annual report to the Public Lighting Commission Secretary Ford Starring has submitted a statement of the receipts for the year ended June 30th as $207,494.50, and the expenditures as $176,860.11. This leaves a balance, including that of a year ago, of $48,154.36. The assets, including unpaid taxes, cash and stock on hand are $72,309.15, while the accounts payable are only $6,440.32. The total investment of the city in the plant now amounts to $790,045.73.

The operating investment for labor and stores, divided between the departments, will show the following on the basis of each $100 expended:

Department.	Wages.	Stores.	Total.
Maintenance	$11 84	$ 4 51	$16 35
Executive	7 67	83	8 50
Station	22 07	20 14	42 21
Trimming	22 07	9 83	31 90
Shop	51	20	71
Injuries		33	33
Totals	$64 16	$35 84	$100 00

The records presented show that during the year the output of the station aggregated 3,281,615 kilowatt-hours, of which 2,975,017 was for arc and the remainder for incandescent lighting. Proportionally the operating expense on this basis was $90,439.85 for arc lighting. There were operated during the year a monthly average of 1,744 arc lights, which would make the average operating cost of an arc light for the year, as figured by the municipality, $51.85, against a cost of $64.19 for the preceding year. The itemized cost for an arc light for the year includes only the following-named charges:

Department.	Wages.	Stores.	Total.
Maintenance	$ 6 14	$ 2 34	$ 8 48
Executive	3 98	43	4 41
Station	11 44	10 44	21 88
Trimming	11 45	5 09	16 54
Shop	26	11	37
Injuries and damages		17	17
Totals	$33 27	$18 58	$51 85

[It will be noticed that these items merely cover

the running expenses of the plant and do not take into consideration interest on investment, depreciation, insurances, water rents, taxes or other charges which make up the actual cost of such service and must be met in some way.]

Transformer Economy.

By Winder Elwell Goldsborough.

Part II.

I do not wish to tire you with figures, but as I believe you will be interested in these comparisons of guaranteed and actual efficiencies, I wish to call your attention to one more case before leaving this matter. Not long ago a manufacturing company requested permission to send a one-kilowatt transformer to the university laboratories for a special test, as the transformer was of a new type and highly efficient. There was no direct guarantee in this case, but the impression was given that the transformer would develop an efficiency equal to, if not exceeding, the efficiency of any other transformer of like capacity on the market. The results of our tests indicated a core loss of 178 watts, a full-load efficiency of 83.6, a quarter-load efficiency of 62.4 and an all-day efficiency of only 54.5 per cent.

There are probably to-day a goodly number of these so-called "highly efficient" transformers eating up the profits of various of our lighting companies throughout the country, simply for the reason that in many cases business managers of electric-light and power plants are not sufficiently alive to the importance of looking after the efficiency of the apparatus forming their equipments just as closely as they look after and check up every item of operating expense and maintenance that is necessitated by the exigencies of the service.

The use of transformers such as the one just referred to would be pitiable. It is fortunate that they do not grow to large proportions, but nevertheless they have a telling effect wherever they fall.

As regards the ageing of the modern transformer irons, I hold rather a conservative opinion at the present time. A great deal has undoubtedly been accomplished within the last few years in the way of improvement in this respect, and the modern transformers that are supplied to us for testing show a wonderful gain in efficiency, due both to the lower initial core losses and to the diminished per cent. of increase of these core losses with the ageing of the iron.

The general opinion seems to prevail at present to the effect that ageing is due directly to the reversal of the direction of the flow of the magnetic flux in, rather than to long-continued heating of, the iron forming the cores of transformers, and this opinion is also expressed in much of the printed matter that has come into my hands.

In a recent lecture delivered by Professor Fleming he said: "It was also discovered, some time back, by Mr. W. Mordey that prolonged slow heating of iron to only 60 degrees C. or 90 degrees C. has a marked effect on the hysteretic constant, and the result is often to increase this constant two or three times. The effect varies with the annealing of the iron, and in many cases the iron which shows the least hysteretic constant at starting experiences the largest percentage increase of it on prolonged heating. This effect is called the magnetic ageing of the iron. Owing to the enormous use of iron for transformer purposes this ageing had now become a very important matter."

"The electrician lays no very great stress on the mechanical qualities, such as tensile strength, elasticity and so on, but he requires high permeability, small hysteretic constant and small ageing; and the iron and steel manufacturer has been able of late years to meet these new requests by producing steel of the necessary quality. Iron and steel can now be produced with a maximum permeability of 4,000 C. G. S units, a hysteretic loss of about .15 watt-pound per 100 cycles per 2,500 flux density, and of non-ageing quality. I do not mean to imply that all these qualities can be equally combined in the same sample, but the iron or steel can be varied to suit the demand."

"Steel can be produced with a higher permeability than wrought-iron for large magnetic forces, and with a superior non-ageing quality."

The fact seems to be well established that non-ageing transformer iron is a commercial possibility, but the fact remains to be demonstrated practically that material of the necessary quality can be obtained in sufficiently large quantities to supply the demands that are being made upon the manufacturers.

Failure in this regard is not the fault of the builders of the transformers, and I have reason to know that there are cases in which disquiet prevails in the minds of managers as to whether or not they are getting what they are paying for. I know that the general claim is made that iron with an "inappreciable ageing effect" is used, and I do not wish to go on record as claiming that it is not used, but what I do wish to point out is that there are transformers being placed on the market to-day that do not contain non-ageing iron. From a large transformer company I have received the following: "at the present time we have not non-ageing iron which will fulfill our specifications of core loss; that which we have on hand will give a core loss of from 20 per cent. to 25 per cent. greater than the amount stated in our specifications." At the present time, therefore, it is needful to make just as careful tests for ageing as for efficiency or for insulation, in spite of the fact that the former take a longer time and are therefore relatively more expensive to make.

During the last three months six transformers of different types have been subjected to most carefully conducted ageing tests in our laboratories. The completed report on these tests has come to me within the last few days and I can give you a resumé of the results.

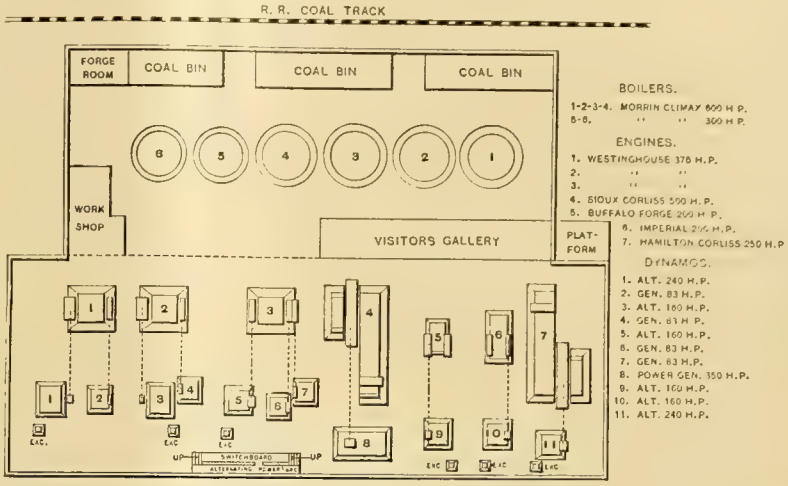


FIG. 4. ELECTRIC SERVICE PLANT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—ARRANGEMENT OF MACHINERY IN STATION.

The core losses of transformers A and B were high to begin with, the first being 72 watts and the latter 83 watts. The per cent. increase in the core loss of these two transformers does not, however, seem to be as great as the per cent. increase in the core losses of transformers C and D that are of more recent manufacture, and that showed initial core losses of 31.5 and 37 watts respectively.

Transformers B and D are of 1.5-kilowatt capacity and transformers A and C of 2.5-kilowatt capacity. An increase of from five to 10 per cent. is shown in all the transformers.

To get an idea of what this means suppose we consider the effect upon the economy of the 2.5-kilowatt transformers, considered in the second case discussed above of a 10 per cent. increase in the core loss. It will add $1.11 per year to the cost of operating each transformer at two cents per kilowatt-hour, or $44.40 for the total number.

This represents an additional gain of 3.7 per cent. per year on the investment in three months, or a possible percentage loss on the investment of 14.8 per cent., after the first year, on the supposition of a uniform increase in the core loss.

These figures are not startling in any way; they are too small for that; but they are matters of fact to be taken into consideration when making investments. The opinions that I am voicing regarding the ageing of modern transformer irons are conservative, as I believe the transformers built to-day will show a marked improvement upon the performance of transformers built even as late as one year ago. As far as the ageing tests that we have made go to throw light upon this subject, I am inclined to believe that the ageing problem has as yet not been solved, as none of the transformers tested have met the requirements of the specifications under which they were submitted, and some have fallen very far short of it. All of the transformers tested were new except transformer A, which at the time these tests began had a core loss already increased to 13 per cent. above its initial value. Transformer A was built about two years ago.

The ageing of transformer iron does not increase at a constant rate with the time. The rate of increase diminishes as the service continues, but the increase may go on indefinitely. Until the use of non-ageing iron becomes more generally possible than at present, it is probable that it will pay to replace the majority of the transformers placed on the market by new ones every few years.

It is our present intention to inaugurate next fall a series of one-year ageing tests under continuous full-load conditions of a representative number of transformers that will be built during the present summer by the manufacturing companies who are interested in having these points thoroughly ventilated, and I trust to be able to publish a record of fine performance in this respect at the time of the completion of the tests.

The correct insulation of transformers is another important point that should be considered by the central-station manager. Like many of the problems with which we have to deal in the effort to make the transformer a commercial success, this one seems to be subject to a wide variety of opinion. The oil insulation of transformers has deservedly

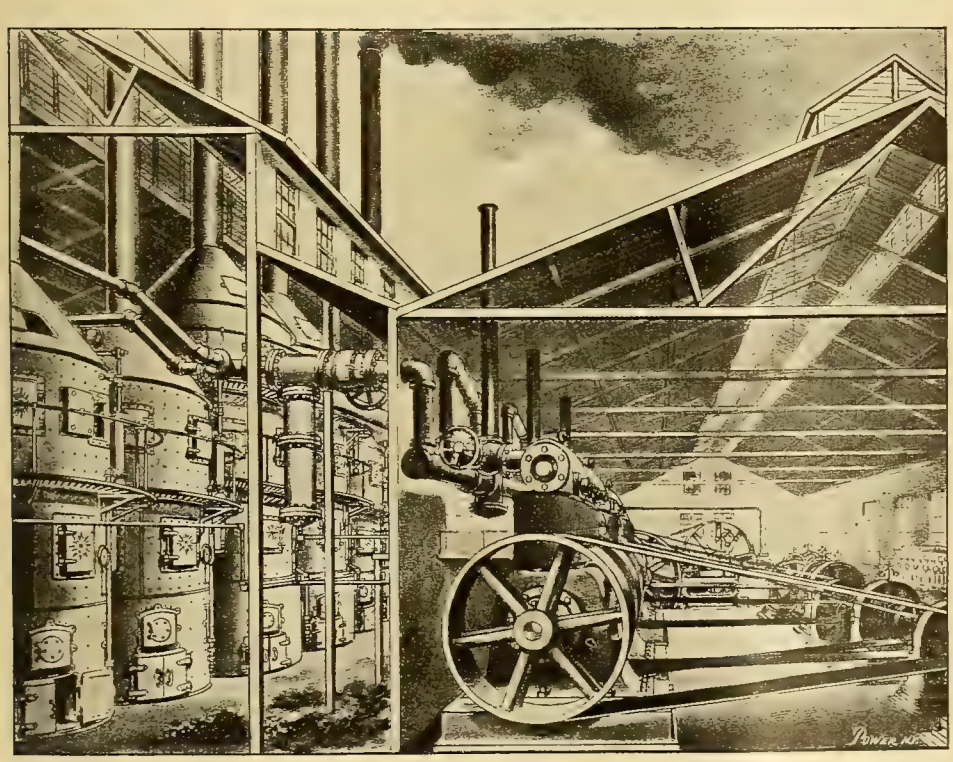


FIG 3. ELECTRIC SERVICE PLANT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—BOILER AND ENGINE AND DYNAMO PLANT.

come into great favor, and where care is taken in the selection of the oils used and in the proper design of the transformer case, high protection is secured. Oil insulation under all circumstances does not, however, secure to the purchaser the protection which he feels he is paying for. The claims that are usually made for the superiority of oil insulation, to wit, that it serves to preserve the insulation from oxidation, reinforces the resistance of the insulation to puncture, reinsulates punctures after the passage of the discharge and facilitates the diffusion of the energy liberated as heat in the core and the coils can in general be readily substantiated.

My experience, however, is that these statements must be regarded as having only a relative bearing upon the subject. Under certain circumstances the insulating value of an oil will be very materially impaired. We are told that transformers will last indefinitely when insulated with oil, whereas without oil the insulation will be so deteriorated after five or 10 years that the transformers should be replaced, and it may therefore be a matter of surprise that the insulating qualities of the oil itself are ever seriously diminished. As a matter of fact experiment shows that the insulating properties of the oils commonly used in transformers are increased as their temperatures are raised up to about 110 degrees C., and that if allowed to cool they will not lose their augmented power of resisting a disruptive discharge. This much might be said in favor of oil insulation, in view of this two or threefold gain in insulating power, were it not for the fact that a continued heating of the oil for any considerable length of time changes the oil to such an extent that on being cooled its break-down value will be only about one-fifth of its original value. And therefore an oil-insulated transformer that will stand an insulation test of 10,000 volts when new may break down under a pressure of 2,000 volts after having been in continuous service for a considerable time. Conditions such as will produce a result of this character are not likely to occur in the case of modern transformers, as the increase in the temperature of even the poorest transformers rarely exceeds 70 degrees C. I have, however, met with cases in which excessive heating has resulted when the transformers were kept continuously in service, and I have also in mind a case in which a good modern transformer was so situated above a tin roof and in a position where it was protected from any breeze that might be stirring, that, when the sun played upon it, its temperature reached perfectly distressing values.

What I have said will serve as a hint of how not to handle a transformer, and the importance of selecting proper places for the location of transformers.

If you will look carefully into the matter you will find that not all of the burn-outs are due to faulty construction on the part of the manufacturer. It is my experience that the contractor has been in fault in a fair proportion of the cases in which the transformer and service installation has suffered.

For all commercial purposes the best oils will be found to give thoroughly satisfactory results and retain their insulating properties unimpaired so long as the maximum temperature of the oil does not exceed 60 or 70 degrees Centigrade. In making a station test of a transformer, if the rise in the temperature of the windings, as measured by the increase of resistance method, does not exceed 50 degrees centigrade, after a 10 hours' run at full load, the transformer may be passed as satisfactory in this respect.

In connection with oil insulation it must be remembered that its efficiency as an insulating medium is impaired by discharges in the oil. One of the foremost claims made in behalf of oil insulation is that it will flow in and fill up a rupture in the insulation of the coils. Every electric discharge that takes place through the oil, however, disintegrates and breaks up the normal structure of the oil, and causes carbon and other conducting compounds to form. These will rapidly multiply if the discharges are at all frequent, and will destroy the insulating properties of the oil.

As a case in point, and I presume you may know of other similar instances, I want to call your attention to a very good example of what good practice vs. bad practice will accomplish.

There is a city in the West in which the conditions under which electricity is supplied for incandescent lighting are somewhat unusual. There are two companies interested in the business, and both employ the alternating-current converter system of distribution. The plant that is operated by the older company was installed about six year ago, and its equipment has grown slowly from year to year as business expanded. Its development has followed the waves of evolution modifying electric-lighting practice within this period, with a lag factor approximating 90 degrees. The plant has some strictly modern machinery, but much of the line equipment is old. A number of its transformers have been burnt out on account of defective insulation; some have been burnt out by lightning and some have shown their efficiency by getting so hot when switched in on an all-day schedule, under light load, that the "oil used to insulate them boiled up and over and ran down the outside of the cases."

It is needless to say that in the latter type of transformer the hysteretic losses were considerable; the transformers were, however, manufactured by a firm of high commercial standing.

The lines of the old company are not protected by lightning arresters except where they enter the station, and the secondaries are not grounded.

The new company has been in operation two years, and its plant is thoroughly up to date and highly efficient. Oil-insulated transformers of from 80 to 200 lights capacity are used and are kept in continuous service. The transformers are of modern design and stand an insulation test of 7,000 volts, without oil. The lines of the new company run over those of the old company and are protected about every 1,500 feet by lightning arresters. None of the secondaries of these transformers are, however grounded, and magnetic shields are not used. The new company has never experienced any trouble from burn-outs of any kind, although its lines are very much exposed. In a very violent electric storm which occurred some time since, in which the service of the old company suffered in consequence of transformer burn-outs, the service of the new company was not interfered with in any way, although lightning struck its lines several times.

There has been a great deal of interest expressed recently in the effort to formulate a definite set of specifications covering the construction and insulation of transformers, with the end in view of decreasing the fire hazard and supplying the necessary protection from loss of life and property to both the producer and consumer of electrical energy.

In a letter that I have lately received from a gentleman who is much interested in the success of this project, he says that after corresponding with a number of makers, engineers and lighting companies to obtain suggestions as to the remedies for the troubles arising from crosses, lightning, insulation, break-downs, etc., the results were very unsatisfactory, as there seemed to be a vast difference of opinion.

I have read a great many articles for and against the use of earthing devices, grounded shields and grounded secondaries, but I am yet to be convinced that the prominent American practice of high-insulation resistance to a disruptive discharge and a plentiful use of well-grounded short air-gap lightning arresters does not give a sufficiently good protection.

As I have already remarked, the number of modern transformers that are reported as burning out is relatively very small. By far the greater portion of the troubles arise from crosses between the high and the low-potential circuits, and in such cases the loss must be attributed to faulty installation, and not to any imperfection in the transformer.

An oil-insulated transformer for use on 2,500-volt primary circuits, or less, having a maximum temperature at full load not exceeding 65 degrees C. and designed to stand an insulation test without oil of 750 volts for five minutes, and a prolonged test of 10,000 volts with oil, will be in slight danger from lightning discharges if protected within a distance of 500 feet by a properly installed lightning arrester.

A transformer should also be able to stand a

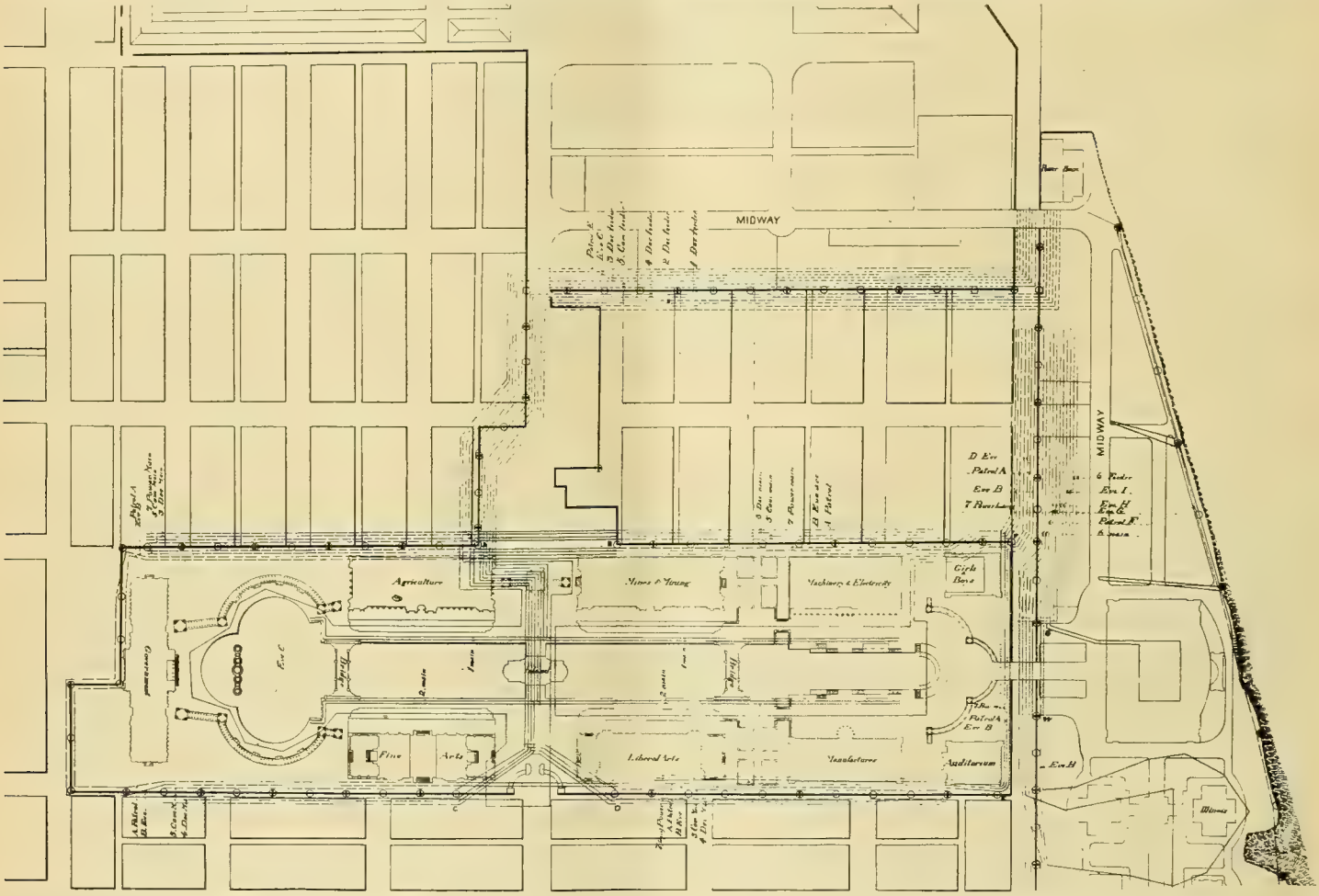


FIG. 6. ELECTRIC SERVICE PLANT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—PLAN OF GROUNDS SHOWING DISTRIBUTION SYSTEM.

double primary potential test for five minues, and the insulation test should be made between the coils and between each coil and the core.

In the case of transformers to be used exclusively on very high-voltage circuits these considerations do not apply, nor should this paper be considered as dealing with this class of alternating apparatus, which has come to form a department by itself.

In considering the economy of transformers, the problem before us is not so much a discussion of their efficiency, as a converter of electrical energy, as it is a discussion of this efficiency in connection with the numerous extraneous causes that tend to make the transformer a menace to life and property.

To my mind a great deal would be gained if an understanding could be brought about between the makers and purchasers of transformers that would result in a uniform practice in the several departments of transformer design. The manufacturers would work to better advantage by having definite specifications to work to, and the way would be open for a bonus or forfeit in equitable proportion to an excess of or shortage in the economy of the product. The fad at present tends toward over-protection. It is bad practice to run to extremes in any department of engineering, and too much protection may turn out to be just as costly as too little.

DISCUSSION.

W. A. Layman, St. Louis: There has been a great deal of criticism of the transformer, and the reason for that can be traced back to the manufacturer directly. The manufacturer has developed the transformer to a large extent without any aid from the central-station man, who has not until recently made any tests of the transformer. The user has accepted the transformer as a switching device or its equivalent, and has not endeavored to protect himself in securing the best apparatus; but of late the competition between manufacturers has developed the fact that there is a great deal of difference in transformers, and now that the subject is being very actively discussed, I think that the central-station man should make a special object of going into it deeply and assisting the manufacturer in developing the apparatus to its highest point. The transformer can be a good piece of apparatus or it can be a poor piece of apparatus. It can be built to conform to definite specifications, and as a representative of a manufacturer I would say that the modern manufacturer would be pleased to have a new set of specifications by which to design the apparatus. There are various standards for comparing transformers; there are various bases for all day efficiencies, and various tests for heating effect, various insulation tests—so many varieties of tests that it is impossible for the manufacturer as well as for the central-station man in general to know just what is required of the transformer. I should like to have the discussion taken up along some of these lines, and if any points of interest arise which can be answered by the manufacturer we shall be glad to go into the discussion later.

George L. Thayer, Belle Plaine, Ia.: In the manufacture of transformers and in the specifications sent out as to the performance of transformers, I have never seen any difference made in transformers suitable for operating lamps at different hours in the day. We have now in the country a comparatively small class of central stations which operate six hours per day; there is another class which operates 12 hours, and there is still another class, which is the growing class, which operates 24 hours. It is evident in the six-hour plant that it would be wise to decrease the iron losses at the expense of regulation, but I have never seen yet any transformer manufacturer who makes any distinction in the transformers for these different classes of stations; at least it does not appear in the published catalogues or reports. He may have different types of transformers which will conform to these various uses, but it seems to me to be a point which has never excited the interest of the transformer man, and, in fact, the owners of the short-hour stations usually look at the first cost of the transformer as the most important matter connected with it.

There is another thing, and that is the protection of transformers from lightning. In a paper read some time ago by Mr. Wurts of the Westinghouse company, he likened the condition of affairs on electrical lines when the lightning strikes the circuit to that of the ripples of the water in a tub when a stone has been thrown into it. It means that the highest rise of potential is not necessarily near the point at which the stroke takes place. It may run off half a mile or a mile before the conditions are just right for a piling up of the potential to extremely high limits. That would seem to indicate that it would not be the best practice possible to place transformers along the line at convenient intervals, but rather to place them at the points where the lightning is more likely to strike. In the case of my own plant, I have never lost so far a modern transformer by lightning. Our losses have invariably been on the older types of transformers, and the discharge in many cases has entered the line, and not only passed several lightning arresters, but has gone to the end of some branch of the line and there burned out some of the old-type transformers, so that in that case the near-by lightning arresters did not protect, although they were in good repair, with an excellent ground.

A. J. Wurts, Pittsburg: The subject of lightning arresters being up for consideration, I shall be glad to say a few words. I do not recall the paper referred to by Mr. Thayer, and his reference to the ripple of water caused by throwing a stone into a tub of water, but I have likened the action of these discharges in the wire to the effect on water in a water trough. The illustration was given by Professor Large and it illustrates what actually happens in the wire. The theory of surging is very pretty and interesting and all that. A great many question whether there is any such thing as the surging of the wire, but whether the theories are correct or not, we have accumulated a great many facts which point to the correctness of the theory. The theory has been adopted since the facts have been developed, and they serve as a happy means for showing to central-station men—giving them a practical illustration—what happens there. I think all of us will admit that these discharges occur at one point or another regardless of any law that we know anything about at all. I have conducted a great many experiments to accumulate data on this particular point. I have connected non-arcing lightning arresters at very frequent intervals over an alternating line, and in series with each lightning arrester have placed a small piece of tissue paper which would be punctured by the lightning discharge. After each storm I have collected the papers and kept a record of the points from which the discharge would occur and the arresters through which the discharge would pass, and I have not found yet that the discharges follow any law whatever. In one case I connected one lightning arrester to three wires running to different points on the main line. All these passed down through one lightning arrester. In each of the three leads I had a small spark gap with the tissue paper, and at different times all the papers were punctured, indicating that there was no one of these paths which

MR. HENRY RUSTIN, SUPERINTENDENT OF LIGHT AND POWER TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.

offered the least resistance for all the discharges. I would like to ask Professor Goldsborough if he will define what he calls a short air-gap lightning arrester, as referred to in his paper.

Prof. W. E. Goldsborough, Lafayette Ind.: I will say that I consider the modern lightning arrester for the protection of line circuits manufactured by the Westinghouse company and the General Electric company, which are now the two prominent types on the market, as being lightning arresters of this class.

Mr. Wurts: The name short-gap lightning arrester is somewhat modern and has been applied to a lightning arrester which has for its path between the line and ground a so-called low resistance in series with a single spark gap. The lightning arrester manufactured by the Westinghouse company has three spark gaps between the line and ground. The presumption is that the lightning arrester having one air-gap is a short-gap lightning arrester in comparison with the lightning arrester which has three gaps between line and ground. When the general requirements for insulating the lightning arresters are such that we provide a No. 4 copper wire between the line and ground, soldering the joints to cut down all resistance, it seems to me strange that we should deliberately put into the lightning arrester a resistance which is high compared with the copper wires leading from the lines to the ground. Furthermore, I will ask a question and endeavor to answer it. It is this: How shall we measure the resistance of the lightning arresters? By what unit shall we measure it? How shall we call one lightning arrester a low-resistance lightning arrester and another one a high-resistance lightning arrester, and by what right is one called a short-gap lightning arrester? I have noticed in print several times the statement that the lightning arrester which will break down with the least electromotive force would be the most effective lightning arrester. I take exception to any such statement as that. The lightning arrester, as a path for lightning discharge, has nothing whatever to do with the dynamo current. If we take a lightning arrester having a single spark gap, and a resistance of 60 ohms connected in series with the spark gap, the dynamo electromotive force which will start an arc which will break down the spark gap is exactly the same as if there were 1,000,000 ohms connected in series with the arrester. That seems to indicate that the breaking-down electromotive force of the lightning arrester has nothing to do in determining the efficiency of that lightning arrester. It seems to me that the only way to measure the effectiveness in the lightning arrester is to determine the resistance which one or more lightning arresters offer to the passage of disrupted discharges. The lightning arrester is to take from line to ground disrupted discharges, and it is hoped it will not take any dynamo current.

How shall we measure the resistance which a lightning arrester offers to the passage of disrupted discharges? The way I have made this experiment has been to connect in shunt to the lightning arrester a variable spark gap, and then send disrupted discharges through these paths in parallel, one of them being the lightning arrester and the other being a variable spark gap. If the latter is closed the disrupted discharge will pass through the so-called gap. Gradually the disruptive discharges, passing at intervals, open the spark gap until the discharge passes either through the arrester or the spark gap. You will reach a point where the discharges will divide, sometimes going one way and sometimes going the other. It is difficult to balance them. The length of the variable spark gap I consider a measure, under these conditions, of the resistance which that particular lightning arrester offers to the passage of disruptive discharges. In making measurements of that kind, between the lightning arrester referred to as having a spark gap and a resistance in series with that spark gap, in making a comparison between that and the Westinghouse non-arcing lightning arresters, I find the arrester having resistance with a short-gap arrester had just three times the resistance which the Westinghouse lightning arrester had, and which lightning arrester had three gaps; in other words, I could place three of the Westinghouse lightning arresters in series, and that series in shunt, and a single short-gap lightning arrester, and the discharges would sometimes pass one way and sometimes the other, verifying the test which I made in placing a single variable spark gap in shunt with the short gap.

H. A. Wagner, St. Louis: I would like to take this opportunity to endeavor to correct an assumption which for several years has been made in considering the average load on transformers, and especially the so-called all-day efficiency transformers. The assumption which Professor Goldsborough has used, and I assume it has been taken by many other writers on transformers, of five hours' average load in the 24, is never realized in practice; I mean, in average practice. The electric-light stations having the largest station load rarely exceed 20 per cent. on the average all the year around. The maximum station load rarely exceeds 50 per cent. of the connected-lamp load. With the use of transformers for house-to-house distribution, it is necessary to have the transformer capacity practically equal to the number of lamps connected. Therefore, with the maximum station output, the transformers will only be loaded one-half of their rated capacity, and if the average station output is 20 per cent. of the maximum, you will have an average load on the transformers of 20 per cent. of their rated capacity, which is 50 per cent., or only 10 per cent. of their rated capacity; apply that to the equivalent number of hours, and a load with the equivalent of a full load for a given number of hours, and it would be 10 per cent. of 24 hours, operated at full load, or 2.4 hours in place of five hours. This average load would somewhat affect Professor Goldsborough's figures, and while in general it would show that transformers have a low average, it would show that the modern transformers are greatly improved over the old transformers.

I would say also that in placing the cost of the transformer load to the central station it would seem more fair to take simply the cost of coal per kilowatt-hour into consideration, as an increased loss in the transformer would not increase any of the labor items or any of the fixed charges in connection with station operation; but, as it only increases the coal consumption, that would be therefore the proper figure to consider when calculating the cost of these losses to the central station. The average cost per kilowatt-hour for coal has been shown by statistics to be somewhere around three-fourths of one cent per kilowatt-hour in the average station. It drops as low as three-tenths of one cent in some few stations, and often it is over one cent; but the average seemed to be about three-fourths of one cent, and that might be a fairer figure to consider in the cost of these losses than the figure of two cents per kilowatt-hour, which Professor Goldsborough has assumed.

E. H. Davis, Williamsport, Pa.: What is considered to be the present rate of depreciation of the most modern type of converter? How often must a transformer be renewed?

Mr. Wagner: That is a pretty hard question to

[*Continued on page 52.*]

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The list of papers to be read before the American Street Railway association at its meeting in Boston in September is announced elsewhere in this issue. As usual, the subjects selected for discussion are of practical importance to managers of street-railway properties, and the gentlemen chosen to prepare papers have had much experience and have attained prominence in the street-railway world. Electricity and electrical subjects continue to occupy an important part of this association's attention, and the electrical features of the exhibition this year, it is promised, will surpass all former attempts in this line. The management is alive to the necessities of the organization and is providing for the wants of the members.

It is not at all wonderful that there have been occasionally accidental explosions of submarine mines in American harbors since the opening of the war with Spain, and when all things are considered we may regard ourselves as particularly fortunate in having escaped serious loss by reason of the presence of these destructive agents. Never before were there so many mines "planted" in such a short space of time as during the period immediately preceding the opening of hostilities, when Cervera's fleet was expected to start for the American coast. Where so much work was hurriedly done, it was natural that some of it should be below the standard, yet it speaks well for the care and skill of those entrusted with the placing of these mines that there have been no fatalities and scarcely any damage to property as a result of their presence. One of the few accidental explosions reported is now attracting considerable attention because of the peculiar conditions attending the unexpected discharge. The incident occurred at the mouth of the Potomac River. It is said that during a thunderstorm a flash of lightning struck the switchboard at Fort Washington which controls all the mines laid along the river, and that three of the mines exploded with tremendous force, sending enormous spouts of water high into the air. Fortunately no damage was done, although it is said that the display was witnessed by many persons who were near enough to feel the force of the discharge. The accident has called attention to the fact that the controlling apparatus of submarine mine stations requires special protection from the elements and from accidental contact with high-pressure wires of all kinds. The work of clearing the principal harbors of the country is now well advanced, but it is to be hoped that the incident related will not be overlooked or forgotten. The subject is one of considerable importance and should be given serious consideration.

Municipalities must exercise more than perfunctory supervision over wires, according to the decree of the Supreme Court of Pennsylvania, in the recent case of Mooney against the borough of Luzerne. In this litigation action was brought to recover damages for a death caused by contact with an abandoned telephone wire. The wire had come in contact with a charged electric-light wire. It was contended by the borough that, while a municipality is invested with police supervision of the wires of corporations occupying its streets, its obligation does not involve pecuniary responsibility, and, if an accident happens from a failure to maintain the wires in safe and proper condition, the corporation owning the wires, and not the municipality, is alone responsible for resulting injuries.

This contention is erroneous, according to the last ruling, for, while the court admitted that it had used some language which would perhaps justify that conclusion, it declares that the duty and liability of the municipality for damages for injuries caused by dangerous defects or obstructions in the highway, whether overhead or at grade, is in no way lessened by the fact that individuals or corporations are subject to a like duty and liability. It maintains that it is the duty of a municipality to exercise a careful supervision over the adjustment and regulation of the electric wires suspended over its streets, and that it is liable for injuries resulting from neglect of such duty. And it says that in view of the multiplicity of overhead wires carrying dangerous currents and the increasing frequency of accidents from defects in such wires, or in the manner of their adjustment, it behooves municipalities to recognize and perform their duties in the premises in more than a perfunctory manner, if they would escape the consequences of negligence.

In considering the case in action the Supreme Court says that the fact that the telephone wire in question had been maintained in the same place for 15 years without accident was no reason why it should continue there indefinitely without inspection. Directly the opposite conclusion was warranted. The court directs attention to the fact that the telephone wire, which had been in the same place for 15 years, had been unused and abandoned for several months; that it crossed a charged electric-light wire, in close proximity thereto, and, finally, that a few months before the accident the old telephone wire sagged to such an extent as to interfere with public travel on the streets. The court suggests that such a condition of affairs should admonish the municipality that more than ordinary care should be exercised, and when it is remembered that the sagging wire was cut by a member of the Borough Council, and one end wrapped around a post within easy distance of pedestrians on the highway crossing the bridge, with the end resting on the ground or in the water, the court goes on to say that the borough had no just reason to complain that the question of its alleged negligence was submitted to the jury. The evidence was sufficient, the court holds, to justify the jury in finding that the accident which resulted fatally was the natural and probable consequence of the manner in which the telephone wire was fastened to the post.

Steam railroad managers are reminded of the growing importance of the electric trolley lines by the marked falling off in suburban traffic in all the large cities of the country at this season of the year. The steam roads running out of Chicago, which have heretofore enjoyed a profitable suburban business, complain that their cars are deserted for the trolley lines since the hot weather set in. Open cars are run on the electric roads and passengers are not annoyed by smoke and flying cinders. An additional inducement of considerable importance is found in the comparatively low fare charged by the electric railway companies. These advantages appeal strongly to those who patronize the lines during the middle of the day when time is not the most important consideration. In the early morning hours and at the close of business the rush still contributes largely to the steam roads.

Reports from other cities indicate that this question is receiving more consideration than ever before, as the passenger statistics of nearly every road show a growing decrease in the number of passengers carried. The annual reports of the Lake Shore and Michigan Central roads and the report of the Massachusetts railway commissioners confirm the gravity of the situation. In the New England states, where the cities are nearer together and electric car lines more numerous, the problem is even more serious than in the territory of the Central Passenger association.

In the 10 years up to and including 1893, the number of passengers carried on the steam railroads in Massachusetts increased at the rate of 5,825,000 a year. The next four years they decreased at the rate of 4,766,000 a year. The decrease in passenger journeys from 1893 to 1897 was more than 19,000,000, or 15.65 per cent. While the number of journeys fell off 15.65 per cent., the passenger-miles fell off only 6.66 per cent., showing that the average journey grew in length nearly 12 per cent. There are six steam railways entering Boston. These lost 12.2 per cent. of their passengers into and out of Boston from 1893 to 1897. There are five electric street railroads that enter Boston, and these gained in the same four years 31.2 per cent. in the number of passengers carried. This is the most significant feature of the report.

In all the reports thus far submitted it is evident that the greatest falling off has been in short-trip passengers. The Lake Shore's decrease in this class was 227,539 persons. The Michigan Central carried last year in local travel 2,385,519, showing a falling-off of 107,798 passengers. The experience of other companies confirms the impression gained from these statistics. An executive officer of a Chicago road is reported to have suggested that perhaps the best policy for the railroads to pursue would be to build a few miles of trolley lines at various points along their own line and bring in the passengers from the surrounding country. These lines would be connected with their own tracks, and the road could carry the passengers between the neighboring towns either over their own rails or on a separate track along their right of way. It is generally admitted by steam railroad men who have investigated the question that the steam road cannot compete with the electric line in this class of service on even terms, especially during the summer months, and experienced managers realize the difficulties of getting back this patronage for the winter season.

American Street Railway Association.

Preparations for the annual meeting of the American Street Railway association have been pushed forward with unusual rapidity this season. Secretary Peningston announces the following list of papers to be read at the meetings, which will be held on September 6th, 7th, 8th and 9th:

"Maintenance and Equipment of Electric Cars for Railways." By M. S. Hoskins, electrician Columbus Street Railway company, Columbus, O.

"To What Extent Should Railway Companies Engage in the Amusement Business?" By W. H. Holmes, general manager Metropolitan Street Railway company, Kansas City, Mo.

"The Carrying of United States Mail Matter on Street Railways." By W. S. Dimmock, general superintendent Omaha and Council Bluffs Railway and Bridge company, Council Bluffs, Ia.

"The Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use." By Richard McCulloch, electrical engineer Cass avenue and Citizens' Railway company, St. Louis, Mo.

"Inspection and Testing of Motors and Car Equipment by Street-railway Companies." By Frederick B. Perkins, electrical engineer Toledo Traction company, Toledo, O.

"Cost of Electric Power for Street Railways at Switchboard; Both Steam and Water." By R. W. Conant, electrical engineer Boston Elevated Railway company, Boston, Mass.

Following is a list of committees appointed for the occasion:

General Committee.—C. S. Sergeant, 101 Milk street, Boston, Mass., chairman; E. C. Foster, 333 Union street, Lynn, Mass.; J. E. Rugg, 101 Milk street, Boston, Mass.; C. S. Clark, 8 Oliver street, Boston; A. A. Glasier, 104 Ames building, Boston; C. Q. Richmond, North Adams; John R. Graham, 280 Washington street, Boston; Robert S. Goff, Fall River; P. L. Saltonstall, 28 Exchange building, Boston; E. P. Shaw, 316 Exchange building, Boston; F. H. Dewey, Worcester Consolidated Street Railway company, Worcester.

Committee on Entertainment.—P. L. Saltonstall, Boston, chairman; H. F. Eldredge, Portsmouth; A. B. Bruce, Lawrence; C. C. Pierce, Boston; C. E. Barnes, Boston; C. W. Wilson, Boston; J. F. Shaw, Boston; J. H. Goodspeed, Boston; J. H. Cunningham, Boston; B. J. Weeks, Quincy; W. W. Sargent, Fitchburg.

Committee on Hall, Hotels and Registration.—E. C. Foster, 333 Union street, Lynn, chairman; John F. Morrill, Quincy; J. N. Akarman, Worcester; J. H. Studley, Jr., Boston; J. E. Rugg, Boston; W. F. Pope, Boston; R. N. Wallis, Fitchburg; H. B. Parker, Boston; A. E. Smith, Springfield; George F. Seibel, Taunton.

Committee on Exhibits.—Charles S. Clark, chairman; H. F. Woods, Boston; E. C. Foster, Lynn; C. F. Baker, Boston; E. P. Shaw, Jr., Boston; Franklin Woodman, Haverhill; R. S. Goff, Fall River; J. H. Studley, Jr., Boston; Maurice Hoopes, Lynn; A. C. Gardner, New Bedford; Edwin S. Webster, Boston; W. F. Pope, Boston.

Committee on Transportation and Information.—Julius E. Rugg, chairman; N. H. Heft, Boston; H. B. Rogers, Brockton; J. F. Wattles, Boston; Fred. H. Smith, Quincy; A. E. Gordon, Boston; N. E. Morton, Lawrence; C. E. Woodward, Wakefield; Winthrop Coffin, Boston; H. H. Reed, Fall River; H. F. Grant, Boston.

Banquet Committee.—A. A. Glasier, chairman; W. A. Bancroft, Boston; Prentiss Cummings, Boston; C. S. Clark, Boston; E. P. Shaw, Boston; E. C. Foster, Lynn; S. M. Thomas, Taunton.

Pacific Cable Project.

It is not to be doubted that the year 1899 will witness at least the beginning of the work of laying a trans-Pacific cable under American control. The annexation of the Hawaiian Islands makes telegraphic communication with them imperative, and there is no doubt that the work will be carried on to the coast of Asia or to some point in Japan or Australasia having cable connection with the mainland. Congress having adjourned, the necessary authority cannot be conferred until next winter, in the ordinary course of events, but advices from Honolulu state that before the formal annexation of the islands to the United States the Executive Council signed a contract with the Scrymser company to lay a cable from the American coast to Honolulu and Japan. The line will run from San Diego to Hawaii and thence to Japan. There is the understanding that the objection of the secretary of state of the United States shall annul all agreements. The provisions of the contract permit the United States to protect itself should it deem the terms inimical to American interests.

Electrolytic Copper Refining.

The development of electrolytic processes for the production of refined copper has proceeded very rapidly during the last three years, and at the present time a large proportion of all the refined copper is thus produced. The Westinghouse Electric and Manufacturing company has installed a large amount of apparatus for this class of service. One of the principal installations is at the refinery of the Anaconda Copper company, Anaconda, Mont., where 10 generators of 270 to 300 kilowatts capacity have been installed. Another very large installation is that of the Boston and Montana Consolidated Copper and Silver Mining company, Great Falls, Mont., where two 810-kilowatt Westinghouse engine-type generators are in service. The latest comer in this field is the Raritan Copper Works of Perth Amboy, N. J., which is about to erect the largest copper refinery in the East. It has contracted with the Westinghouse company for three 600-kilowatt, 150-volt, engine-type generators to be driven at 150 revolutions per minute, with a nine-section switchboard for electrolytic service and the operation of two 75-kilowatt, 220-volt, engine-type generators, which will be used for lighting and power service. It is said that the installation will be the most complete of its kind in the world.

John Mason Jackson.

Press dispatches and private letters bring the sad news of the death in Honolulu on July 6th of John Mason Jackson, the secretary and treasurer of the Western Electric company. Mr. Jackson had been in poor health for some time, but, until the newspaper report of his death, his parents and friends in Chicago had received encouraging news of his condition in Hawaii. Never a man of rugged strength, Mr. Jackson broke down from nervous prostration a year ago last winter, and in February, 1897, he left his desk in Chicago to seek rest and strength in the Clifton Springs (N. Y.) Sanitarium. From there he went to the Adirondacks, and he seemed much improved. His physicians thought that while he was not strong enough to resume the onerous duties of his position at once, he might undertake light business duties, especially

JOHN MASON JACKSON.

if they could be combined with the pleasures of foreign travel. It was accordingly arranged that he should go to Japan for the Western Electric company. He was to take matters easily, and, as he was perfectly familiar with the foreign business of the company, it was thought likely that he might return by way of Europe, reversing a previous trip around the world, from west to east, that he had taken for the company. This plan was only partially carried out, Mr. Jackson returning directly from Japan, instead of going on. He stopped in Honolulu for an extended stay in the pleasant climate of the Hawaiian Islands, and was thought to be doing well. The immediate cause of death, it is understood, was an affection of the throat—perhaps diphtheria. Mr. Jackson expressed a willingness to be buried in Honolulu, and this disposition was made of his body. His last moments were peaceful and he was surrounded by friends.

Mr. Jackson was a quiet, unostentatious man, but his services were of great value to the Western Electric company and were justly appreciated by President Barton and his fellow-officers. He had been with the company 16 years and was at the head of the department in charge of the financial end of the business—the contracts, accounts and the like. He possessed a clear intelligence and great mental activity. He was not only a very truthful man, but it is said of him that he possessed the genius of accuracy. He was thorough and was perfectly acquainted with all the details of the business in his department, including the transactions in the foreign branches of the company. He was fair-minded and just, and, while thoroughly loyal to his own convictions, he never underrated or disregarded his opponent's contention, either in a business dispute or social discussion. He had a disciplined mind, and he was able to concentrate the whole power of his thought on the subject in hand. Thus, for instance, in preparing a digest of any business controversy for legal opinion, he had the faculty of following the course of the true "bone of contention" through a mass of material and presenting it in a compact form, with all the essential facts and no superfluous verbiage. So, too, his annual reports were models of clearness, thoroughness and excellence.

In addition, it is to be noted that Mr. Jackson bore the reputation among those who knew him best of being a many-sided man. He was devoutly concerned in religion; he had a decided taste for mathematics; he was highly praised by his college professor for his skill in Greek; he was well versed in English literature; he was a thorough student of the philosophy of American history, and he took a deep interest in all the economical and sociological problems of the time. Two years ago he was decided in the opinion that the gold standard of coinage should be retained by the United States, but his conclusion was not influenced in any degree by the exigencies of partisan politics, but rather by his own painstaking study of the money question. With it all, Mr. Jackson was kind and considerate to others and tried manfully to do his duty in the world.

Virden, Ill., was the birthplace of John Mason Jackson, and he was born on June 17, 1859, while his father, the Rev. Dr. J. B. Jackson, was pastor of the Baptist church at that place. The boy was precocious and had to be restrained rather than encouraged in his studies. When he was eight years old the family removed to Chicago, and Mason, as he was known, grew to manhood in this city. He was not a strong boy; his mind always seemed to be too active for his body; and his formal education was interrupted in consequence. But he went to the Chicago schools and attended the old Chicago University. He did not graduate from the latter institution, but was known as a bright student. While a boy he worked for Fuller & Fuller, the wholesale druggists, and did some bookkeeping for Gray & Barton, who had a shop for the manufacture of electrical supplies and instruments. The latter establishment was the nucleus of the present plants of the Western Electric company, and at the age of 23 young Jackson entered the service of the company as a bookkeeper. His integrity and ability were recognized, and he was advanced until he became secretary and treasurer of the company. Mr. Jackson was a member of the Quadrangle Club and a directors' member of the University Club. He was also an active member of the Hyde Park Baptist Church. He was unmarried and lived with his parents at 5726 Monroe avenue.

Association of Edison Illuminating Companies.

The Edison convention is an event of considerable importance to the working forces of the companies operating Edison apparatus throughout the country and to the men whose capital is invested in these undertakings. There are in the neighborhood of 70 central-station systems represented in the Association of Edison Illuminating Companies, and these corporations have an actual cash investment of $120,000,000.

This year's meeting, which will be the nineteenth gathering of the organization and the fourteenth annual convention, will be held at Sault Ste. Marie, beginning on Monday, September 12th, and continuing until Wednesday noon. It has been arranged to make the trip by boat over the Great Northern Steamship company's line, as an unusually large eastern delegation is assured. The eastern members will assemble at Buffalo on September 9th and embark there, while members living west of Buffalo will assemble at Detroit and join the party at that point on Saturday, September 10th. The Chicago contingent will start on Friday night, September 9th for Detroit. The return trip will also be made by boat, leaving the Soo Wednesday afternoon, September 14th.

The programme this year will differ somewhat in character from the plan of former meetings. It is proposed to make a special feature of the subject of "Methods of Charging." Four or five papers will be presented by representatives of the principal Edison companies of the country, dealing with the several features of the problem. These contributions will then be subjected to general debate. The Brooklyn company has promised to have a paper on "Developments in Transmission Apparatus" prepared by its engineering department, and the New York company will present a paper on "Meters." It will also present a report on what was seen by its engineering commission abroad. It is anticipated that this will prove a very valuable contribution as well as an entertaining paper. The question of "Municipal Ownership" will be considered, and it is expected that Samuel Scovil of Cleveland will prepare a paper on the subject. This programme will be supplemented by a number of papers by representatives of smaller companies on questions of operation and other practical subjects. The feature of the meeting will be the report of Wilson S. Howell on the work of the lamp-testing bureau which has been conducted by the association for a year and a half. This report will describe the work of the bureau and explain the operation of the arrangement by which the companies comprising the association purchase lamps made under specifications furnished by the association.

All of the meetings will be held in executive session, as usual, but it is quite probable that President Insull will make arrangements for the publication of such papers as may not interfere with the business of the members.

DEVELOPMENT OF THE TELEPHONE FIELD.

Home Station Switchboard for Toll-line Systems.

By H. P. Clausen.

There is a wide difference in the requirements of switchboards designed respectively for a local and toll-line service. With the first kind of service the switchboard equipment must be designed with the special object in view of enabling an operator to serve a large number of individual lines, whereas the operator of a toll-line switchboard needs to serve but a comparatively small number of lines. Inasmuch, however, as the average toll line has more than eight or 10 subscribers' telephones connected to its circuit, the duties of a toll operator serving 10 lines are no lighter than those of a local operator provided with the usual allotment of individual lines. Realizing the absolute necessity and anticipating an early demand for a uniform method of interconnecting toll-line circuits, the writer submits the description of a home station switchboard as the first of a series of articles bearing directly upon the problem.

Referring to Fig. 1, we have four distinctly different styles of toll systems. A represents the

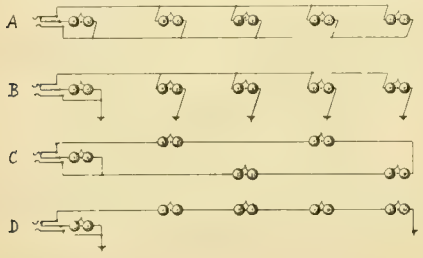


Fig. 1.

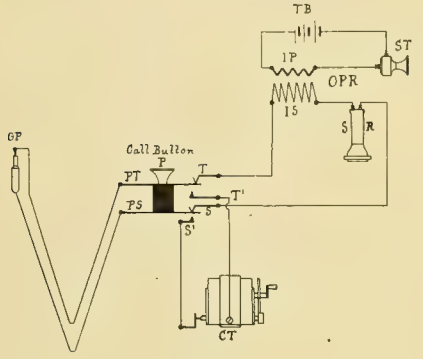


Fig. 2.

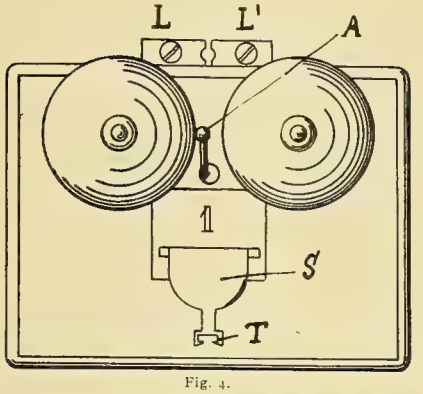


Fig. 4.

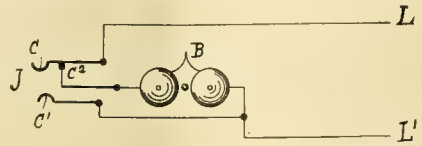


Fig. 3.

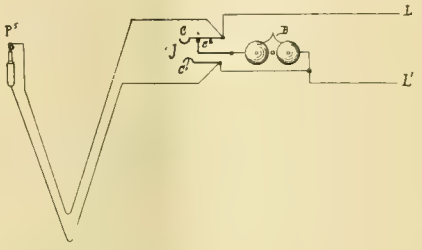


Fig. 5.

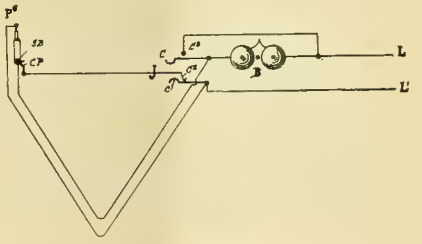


Fig. 6.

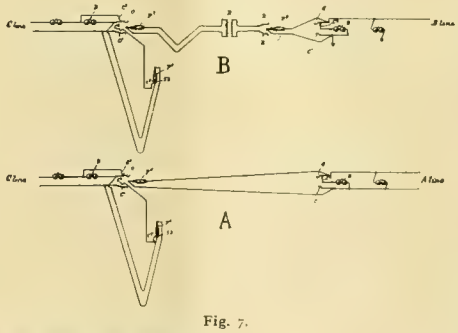


Fig. 7.

HOME STATION SWITCHBOARD FOR TOLL-LINE SYSTEM.

metallic-circuit bridged telephone system, and B, though equipped with the same style of telephone instruments, employs the earth as a return path. C represents the well-known series-metallic circuit, and D the most widely employed earth-return series system.

Fig. 2 represents the operator's equipment. It consists of a metallic circuit plug, which is by means of a double-conductor cord permanently connected to the P T and P S springs of the call button P. Normally the call-button springs remain in contact with the back stops T and S, which, as will be observed, connect to the operator's telephone set O P R, permitting a talking circuit to be established by the mere insertion of the O P plug into a caller's line-jack. When it becomes necessary to "ring out" or operate the signal-receiving apparatus of the telephone stations on a given line, the call-button P must be depressed. The result is that the P T and P S springs lose contact with the T and S back stops, and make contact with the stops T' and S', which are connected to the magneto generator C T. Now, if the call transmitter be operated while the call-button remains depressed, the current generated will, of course, find its way through any circuit connected by means of the O P plug, but the instant the call-button is released it automatically restores the operator's telephone circuit to its normal condition, and is consequently in readiness for receiving an immediate response from the called party. Probable criticisms, based on the fact that the form of operator's equipment is primitive and too slow, will receive little consideration from those who are familiar with the requirements of a toll-line switchboard.

In most systems, when there is more than one telephone connected to a given circuit, the subscribers thereon are allowed the privilege of calling one another without first calling the switchboard operator. If, however, the switchboard is equipped with a signal receiver which on the passage of a calling current releases a nominally suspended shutter, every call made on a certain circuit would require some attention on the operator's part, even if the call were being made for a subscriber in connection with the caller's circuit. Referring to Fig. 3, we have an ordinary metallic-circuit spring-jack J, and in order to avoid the difficulties just mentioned a magneto bell is arranged to take the place of a regular line drop. In practice the arrangement works admirably, and wherever introduced new friends are made. However, there are a skeptical few who, for several reasons, are loath to part with the descending annunciator shutter, though favorably disposed toward the audible signal; therefore provision is made to give them both the magneto bell and annunciator drop signal combined into one piece of apparatus. Such an arrangement is shown in Fig. 4, where S is the annunciator shutter and T a double-pronged projection which engages with the magneto-bell armature rod A. This piece of apparatus works well when properly made, and it is obvious that by the addition of a local-circuit closing spring an incoming call might easily be made to close an auxiliary bell circuit.

The next consideration will be to provide the simplest means for interconnecting toll-line circuits as shown by Fig. 1. The A and C line, which employs metallic circuits, presents no particularly serious objections to a direct interconnection, but when the A line is required to be connected with either the B or D circuit, which are grounded at each end, a direct connection would tend to upset the balance of the A line, thereby destroying the advantages gained by having a metallic circuit. However, even though a fairly satisfactory service may be rendered by means of direct connections, as a rule it should not be done.

Referring to Fig. 5, the line-jack J and magneto bell B and the plug P 5, connected to the jack-springs C and C', are shown. This arrangement of circuits serves for both the bridged metallic and bridged earth-return systems.

For the series lines, both metallic and earth-return, the switchboard terminal is arranged as shown by Fig 6, and is in a general way similar to the apparatus employed on the bridged line terminals. If we trace out the circuits, beginning at L, we find that, after passing through the magnet bell B, the circuit is continuous through to the plug seat S B. When in its normal position the plug seat rests in its socket C P, which is electrically connected with the stop C 2 of the C' line spring, thus completing the circuit from L to L'.

With this description of the general idea of the construction of the switchboard, we may proceed to explain its operation. Referring to Fig. 5, let it be assumed that a call for that station has been received by an operator provided with apparatus as shown by Fig. 2. The operator's first act would be to insert the O P plug into the caller's jack, thus putting herself into communication with the caller's circuit. It might be mentioned that when the operator inserts the O P plug into the jack J 5 the spring C breaks its contact with the stop C 2, thus cutting out of circuit the bell B. On learning the caller's needs, which we will say is a request for a connection with the metallic series line as shown by C in Fig. 1 and J in Fig. 6, the operator withdraws the O P plug, and inserts it in the line-jack of the C circuit, and on finding it clear depresses the call-button P, and while operating the magneto generator C T transmits the proper code signal, after the completion of which she releases the call-button and awaits a reply from the called party, on the receipt of which she picks up the P 6 plug and inserts it into the J 5 jack, which act interconnects the circuits of the caller and called party.

Referring to Fig. 7 (A), it will be seen that the A and C circuits are shown connected together direct with the A (P 5) plug inserted into the C line jack, the A bell serving as the clearing signal. The C bell, it will be observed, is shunted out of circuit by the insertion of the plug P 5, which forces the C 6 jack-spring into contact with the C 3 stop. With the above condition an operator might at any time "cut in" on the connected circuit by means of the plug O P and the jack A. Fig 7 (B) shows also the method adopted for connecting together a metallic with an earth-return circuit (B and C, Fig. 1). The interconnection is made in a manner similar to that of the A and C circuits with the exception that the repeating-coil jack and plug is made to form a part of the circuit, as indicated.

Montevideo Telephone Company.

An extraordinary general meeting of the shareholders of this company was held in London recently at which the chairman said that the object of the meeting was to pass a resolution to reduce and sub-divide the capital of the company, so that it might more accurately represent the company's assets. The directors were animated with but one object, and that was to improve the position of the company. He was reminded by the date of the meeting that they were within three weeks of the tenth anniversary of the incorporation of the company, and their prospects, which seemed so prosperous in 1888, became suddenly shattered by the collapse in Uraguay two years later, a collapse by which all commercial enterprise in the country was paralyzed. They had survived those years of panic and trouble, and improved the efficiency of the service, struggling all the time to carry out their expectancy as to a return on the capital. They had been able to pay four per cent. on the six per cent. preference shares for the last four years, and had kept their plant up in an efficient manner, which showed that they had a sound business to deal with, and the time had now arrived when it was desirable to so rearrange the capital that its present earnings might be fairly distributed. The suggestion for the rearrangement first emanated from a very large preference shareholder, and one who happened to hold no ordinary shares whatever. So long as a share did not earn its full dividend it suffered a market depreciation, and therefore a five per cent. preference share on which the full dividend was paid would be of more value than a six per cent. share on which only four per cent. was paid. The directors had therefore proposed the following rearrangement of the capital, which was equitable to all parties: (1) To give to the present preferred shareholders, for every share which they now hold, three £1 cumulative five per cent. preference shares, non-preferential as to capital, and two £1 ordinary shares; (2) to give to the present ordinary shareholders, for every share they now hold, one £1 ordinary share; (3) to give to the holders of the promisory notes, issued in lieu of dividend in 1892, three preference shares of £1 each, and two ordinary shares of £1 each for every £5 so held. If the arrangement was carried through there was every prospect of the full dividend being paid on the preference, and also of a dividend being paid on the ordinary shares. The chairman concluded by proposing a resolution for carrying the arrangement into effect, which, after some discussion, was carried unanimously.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Northwestern Telephone Exchange company is taking out the old-style instruments as fast as possible in Minneapolis and replacing them with new telephones which have neither a bell crank nor a cell battery. The new system includes a storage battery at the central office, and the operator is called by taking down the receiver, so there is no need of the old devices any longer. The new instrument is a great improvement, and communication is much easier with it.

A movement is on foot in Iowa for the merging of all the independent telephone toll lines into one organization. Propositions have been forwarded to the managers of the different companies, with every indication that they will be accepted, and a meeting to outline a plan of consolidation will probably be called to be held in Des Moines shortly.

The Iowa Telephone company announces that it will pay the war-revenue tax on long-distance telephoning.

The Humeston Telephone company of Humeston, Ia., has its new exchange ready for business.

W. B. Taylor, who has been head operator of the Rochester, Minn., automatic telephone exchange, has resigned to go to Schenectady, N. Y.

A telephone line is being built between Redfield and Stuart, Ia., by the Perry Telephone company.

The new telephone exchange at Guthrie Center, Ia., has been completed and put in operation. It starts with 53 instruments in use.

J. M. Kelley, manager of the Iowa Telephone company's office at Fort Dodge, Ia., has been transferred to Waterloo, Ia. He is succeeded by A. M. Childs of Sioux City.

The Central Telephone company has been voted a franchise by the people of Manson, Ia.

The Town Council of Riverside, Ia., voted a franchise to the Iowa Telephone company.

The Iowa Telephone company has been granted a franchise at Wellman, Ia., by the council, and will build to that place as rapidly as possible.

Carl Eastwood and others of Menahga, Minn., are interested in a project to build a telephone system to connect Park Rapids, Minn., with Menahga and Hubbard, Minn.

The long-distance telephone lines have reached Lake Benton, Minn.

J. J. Greaves is putting in a telephone exchange at Glencoe, Minn.

The Northwestern Telephone company has completed toll connection between Oshkosh and Winneconne, Wis., over the lines of the Little Wolf River Telephone company.

The Citizens' Telephone company of Mankato, Minn., invites bids until 8 p. m. July 29th for constructing a telephone exchange.

The Iowa Telephone company is extending its line from Charlotte, Ia., to Bryant.

The People's Telephone company has about completed telephone communication between Ottumwa, Ia., and Oskaloosa.

W. B. Aris, manager of the enterprise engaged in building a telephone line from Spokane, Wash., to Rossland, announces that the company will soon put in metallic wire from Rossland to Spokane for through business. The local stations will not be connected, however.

Drawbaugh Company Secures Franchise in Philadelphia.

The Philadelphia Common Council has at last passed the ordinance granting the Drawbaugh Telephone and Telegraph company a franchise to establish and operate a telephone-exchange system in that city. The ordinance authorizes the company to lease or purchase any underground conduit, or systems of cables and wires, that may have been, or may hereafter be, constructed by the city, or by any corporation, firm or individual under existing ordinances. The company is required to furnish for the use of the city, without cost, two ducts or chambers in its conduits of not less than two and one-half inches in diameter. Free telephone service is to be afforded city departments, including the police station houses, one school building in each section, the residences or places of business of the chairmen of the finance, highway and survey committees, the offices of the presidents of the City Councils and to the residences of the chief clerks of Councils. The company is required to fix the maximum cost of its annual service per instrument for business houses at $75 per annum, and for private dwellings at $50 per annum, over both public and private wires, and without regard to distance inside of the city. The company shall pay to the city, annually, three per cent. of its gross receipts, submitting a statement to the city controller. Within 90 days from the passage of the ordinance the company shall file its plans, and it shall commence its work within 90 days after such plans are approved by the directors of the Departments of Public Works and of Public Safety, and shall expend not less than $100,000 in work and material within one year. For the faithful compliance with the terms of the ordinance, the company is required to give bond to the city in the sum of $50,000.

Col. Joseph F. Stokes, president of the Drawbaugh company of Philadelphia, expressed his satisfaction at the passage of the ordinance. "We feel now," said he, "that we are getting something of our due. It has been a long struggle and we believe that the right has come out on top." Colonel Stokes has received many letters of congratulation on the passage of the ordinance. Armon D. Acheson, secretary of the Commercial Exchange, Alexander M. DeHaven, who introduced the bill in Councils, G. Alexander Hamilton of the London-Glasgow Manufacturing and Colonization company and other prominent Philadelphians were included in this list. John D. Ford, treasurer of the company, said it was a matter for congratulation that Drawbaugh, a Pennsylvanian, and the inventor of the telephone, should have his genius first recognized in his own state and in the principal city of that state.

Upon the adoption of the ordinance Colonel Stokes and John R. Bartlett of New York, president of the parent company, held a conference and discussed plans for the proposed exchange. It was announced that plans would be filed with the Department of Public Works immediately upon the approval by the mayor of the council's action.

Detroit Telephone Litigation.

[Special correspondence of the Western Electrican.]

Detroit, July 14.—Before Judge Henry H. Swan of the United States Circuit Court on Tuesday was begun the hearing for a temporary injunction in the suit brought by the Western Electric company of Chicago against the Detroit Telephone company.

The complainant charges that the Detroit company has incorporated into a switchboard certain devices which are an infringement upon patents held by the Western Electric company and used by it in the manufacture of telephone switchboards. The particular device mentioned is the one for enabling the operator to tell whether a line is busy or not.

G. L. Roberts and F. P. Fish of Boston and George P. Barton of Chicago represent the complainant, and R. A. Parker, H. H. Hatch and Charles Flowers appeared for the defendant.

When the hearing was begun the tables in the United States Circuit Court were littered with drawings, blue-prints, Patent Office reports and models. Through these the attorneys waded, giving extended illustrated explanations of how electricity travels in and out and around a telephone switchboard, with special reference to how it gets to the telephone operator and gives warning that a line is conversationally employed.

It appears that this "busy" device in the Bell telephone system consists of a supplementary line which is connected with a battery and is grounded. When the line is busy and the telephone girl attemps to get in on it, current from the special line flows through the telephone at her ear and makes a click. The complainant insists that the Detroit company learns of a busy line by a click obtained in the same way in principle.

The defense has filed a batch of affidavits, blue-prints and diagrams in its own behalf, some by Professor Carhart of the University of Michigan. All the patents involved in the case were submitted to him, together with a complete explanation of the switchboard of the Detroit Telephone company. Professor Carhart says in his affidavit that he has been teaching physics at the University of Michigan for 12 years, coming from Northwestern University, where he taught for 14 years; that he has always kept in close touch with the development of the telephone and knows personally Professor Gray, Charles E. Scribner, C. D. Haskins and others upon whose patents the claims of the Bell company are founded, and of their work and patents, and has made a special study of telephones, and has appeared as expert witness in a number of cases where electrical patents were involved. He served as president of the board of judges upon electrical appliances at the World's Fair in Chicago and was a member of the jury to make the awards in electricity at the Paris Exposition in 1881. He says that he has made a very complete and careful examination of the two switchboards and of the patents involved in the case.

As to the "busy" device, the professor says that in the Detroit company's switchboard the current for giving the click in the operator's ear is obtained by tapping the current that flows over the line that is in use, while in the Western Electric switchboard there is a supplementary battery and special line for the purpose. Further, the switchboard of the Western Electric company is a system of independent boards, by the statement of the inventor, while the switchboard of the Detroit Telephone company is a development of the trunking system of connected boards. In his opinion, therefore, the switchboard of the Detroit company does not infringe on the one built by the Western Electric company.

The same opinion is arrived at by Professor Edwin J. Houston and by Dr. A. E. Kennelly of Philadelphia.

The arguments of the counsel proceeded all day Wednesday. The defense had its inning in the morning and F. P. Fish of Boston closed for the complainant in the afternoon. Judge Swan then gave the attorneys until August 10th to file briefs.

F. G.

The Telephone in Italy.

[From the London Electrician.]

The telephone concession for Florence includes the town and the adjoining suburban commune, with a population of about 250,000 inhabitants. The telephone was introduced into Florence by two companies—one Italian and one English—both holding concessions for Bologna as well as Florence, the Italian concession including Leghorn. In 1883 the two companies amalgamated and formed the Societá Telefonica per l'Italia Centrale, with a capital of £60,000. The early concessions granted by the government had only the duration of three years, after which the government was at liberty either to renew the concessions, grant new ones, or to establish governmental telephonic communication To this latter effect the government presented a bill to Parliament by which all the existing concessions at their expiration were canceled without any right of compensation or any obligation on the part of the government to buy the lines and offices already established. This bill, approved by the Lower House, was rejected by the Senate. A new bill was then presented and approved by Parliament by which the right of granting concessions for private or public telephonic communication was entirely reserved to the government. The law fixed the duration of each concession to 25 years, after which all the plant, line and premises become the property of the state. The government has also the right after 12 years from the date of each concession to take possession of the concern by paying a sum equal to the average net profit of the three preceding years multiplied by the number of years which each concession has still to run to reach the final period of 25 years determined by law. The same law establishes a tax of 10 per cent. on the gross profits of each concession for public use, the right of free communication for all the postal and telegraphic offices, and a reduction of 50 per cent. on the public tariff in favor of all government, provincial and municipal offices. As a compensation, however, the companies have the right to fix wire supports on all public and private properties. When a private proprietor refuses to grant the permission a simple application to the prefect is required to obtain the enforcement of the law. The proprietor may ask for an indemnity, and if both parties do not agree the prefect decides. As soon as the Italian telephone companies saw their existence insured for a fixed period they began to reorganize their services by changing the apparatus, wires, etc., with the object of diminishing working expenses so as to enable them, besides distributing a dividend to the shareholders, to yearly set apart a sum for the reimbursement of the capital at the expiration of the concession. Experience proved that these objects could not be attained by small companies on account of the heavy expenses of management and the necessity of having a uniform technical direction, and they therefore amalgamated and formed larger companies. This amalgamation is now under execution. Florence is now a branch exchange of the Societá Generale Italiana dei Telefoni ed Applicazioni Elettriche, with a capital of £240,000, which owns the telephonic exchanges of Rome, Naples, Genoa, Palermo, Venice, Leghorn and most other important towns, with the exception of Milan and Turin, where the old local companies have formed the Societá Telefonica per l'Alta Italia. The number of subscribers in Florence is only 900, and the following is the tariff of rates charged: £6 8s. within 1,093.61 yards from the central office, £7 4s. within double that distance, £8 within three times that distance, and for further distances 5s. 8d. for every 218,722 yards. The apparatus and instruments were wholly supplied by the Antwerp Telephone and Electrical Works. The wire used is silicon bronze for the lines in the interior of the town, and steel or iron for the country. All subscribers have the right to complete service day, night and Sundays. The operators are females, hours from seven to eight per day, salary from £1 5s. to £2 10s. per month. A fortnight's leave of absence is granted yearly and a holiday on each alternate Sundays. Workmen employed in the maintenance of apparatus receive from 1s. 8d. to 2s. 6d. per day; linemen from 1s. 8d. to 2s. 1d., with a holiday on every alternate Sunday and a half-holiday on Saturdays. All workmen are insured against injury or death, this insurance being obligatory by law. In case of injury full wage is paid during illness; in case of permanent disablement 900 days wages, and the same compensation is due to the families in case of accidental death. In ordinary sickness workmen are supported by the company for a certain period, according to length of service, but in no case under three months. Hours of work, 10, with 2d. for every extra hour. During the summer months a few days' holiday is granted. Each workman has from 150 to 200 instruments to look after. The original local company distributed a dividend varying from two to three per cent. The new amalgamation has not yet published a balance sheet, but it is expected that the dividend, if any, will not be in excess of the above rate. With a 10 per cent. concession tax and 20 per cent. income tax and the necessity of refunding the capital, very little extra profit is likely to be available for distribution.

C. S. Weisse & Co. have completed their electric-light plant at Sheboygan Falls, Wis., and put it in operation.

Macrae Curve Tracer and Curve Integrator.

The difficulty of keeping reliable records of the daily operations and output of electric-light and power stations is familiar to every station superintendent. The usual method of taking readings of the different instruments at regular intervals and entering them into a log-book, from which curves are traced on the following day, is unsatisfactory for several reasons. The amount of clerical work necessary to be done in order to produce curves that are sufficiently accurate to be of any practical value is so great that in the majority of stations no attempt is made to keep such records. It is easy to understand why it is difficult to obtain accuracy in records kept in this manner, when it is considered that usually three or four persons are responsible for the figures representing one day's operations, and that the services of still another person are required to plot the curves from these figures. A switchboard operator seldom has much experience in the duties of an accountant and he is often obliged to use writing material one moment and an oil can or similar piece of apparatus the next. These facts offer a ready explanation why these records frequently cannot be deciphered even by those who have written them.

The importance, or rather the necessity, of having trustworthy curves to show how the conditions in an electric-light or power house vary from hour to hour is so obvious that it is hardly necessary to dwell upon it. Without such curves it is impossible to have any definite idea of where losses occur or in what direction improvements should be made in the operation of the plant.

In stations where storage batteries are used it is absolutely necessary to keep accurate records if losses in current and injury to the battery are to be avoided. In such stations the switchboard operator should have constantly before him something to show what work the battery has just been doing, in order that he may be able to give the battery proper attention and make use of it to the best advantage. For this purpose curves traced in the usual manner are obviously of no service, as the occasion for which they are needed arrives before the curves are made out.

When one switchboard operator relieves another he should have the means of becoming thoroughly acquainted with all the conditions existing up to and at the time that he comes on duty. This is necessary in order that he may know what has to be attended to. To furnish this information, the records should be complete up to the time that he takes charge, and arranged in such a manner that a person familiar with the work can understand the whole situation at a glance. This latter point is important, because a switchboard operator usually has so much to attend to that he cannot devote much of his time to finding out what has been done by those who were on duty before him.

The apparatus represented by the accompanying cut (Fig. 1) was designed for the purpose of diminishing to some extent the amount of bookkeeping necessary to be done in connection with station records. The method of operating the instrument is somewhat similar to that of operating a cash register. Its construction can be readily understood by reference to the cut. The sheet of paper on which the records are to be made is drawn forward between two rollers by means of a small lever and ratchet on the end of one of the rollers. A number of pencils, corresponding to the number of curves desired, press against the paper and trace the curves as the paper is drawn forward.

Each pencil can be set in any position relatively to the width of the paper by means of a gear wheel engaging into a rack cut on a flat piece of brass on which the pencil is mounted. The shaft on which this gear is fixed is provided with a pointer, which moves over a divided scale, and also with a small lever, by which the pointer and the pencil connected with it can be set in different positions.

Each time the readings of the different station instruments are to be recorded the dial indexes connected with the pencils are set to the points corresponding to these readings. The lever operating the paper is then drawn back against a stop and released. This forces the paper forward a definite amount and each pencil adds a corresponding amount to the curve that it is tracing.

The amount of paper fed forward each time that a reading is taken can be varied by means of an adjustable stop which determines the range of motion of the lever which operates the feed roller.

When, as in the case of ampere-hours, a time dimension enters into the quantity of which a record is to be made, the dial is provided with two index hands mounted on one shaft in the same manner as the hands on a clock dial. One of these indexes, which may be called index No. 1, is fixed on the shaft and marks the position of the pencil which traces the curve. The other, or No. 2 index, is connected to index No. 1 by means of a clutch in such a way that when index No. 1 is moved forward it brings No. 2 index along with it, but when index No. 1 is turned in the opposite direction the clutch is released and index No. 2 does not move.

Each time that No. 1 index is to be set for a reading, it is first moved back to zero and then brought to the position in which it is to remain until the next reading is taken. By this operation No. 2 index is made to integrate the curve traced by the pencil connected to index No. 1. For example, if the pencil is tracing an ampere curve the reading of No. 2 index will be the number of ampere-hours represented by that curve. In order that the reading of No. 2 index may represent ampere-hours directly, the relative rates at which the indexes move over the dial must be determined by the number of readings taken per hour. For instance, if five-minute readings are taken No. 1 index should pass over 12 scale divisions while No. 2 index is passing over one division. If, however, there is occasion to take readings of any other frequency, without altering the ratio of the gears connecting the two indexes, a reducing factor must be employed in connection with the dial indications.

The instrument can be used either with ordinary pencils or with inking pens. Curves traced with ink can be made in different colors, and are more readily distinguished. In most cases, however, it will be found more convenient to use pencils, as the pens require some little attention in order to keep the ink flowing freely.

The part of the paper containing the curves of one day's operations can be cut off and filed away in the regular manner, or the paper may be wound on another cylinder until the whole roll is used up.

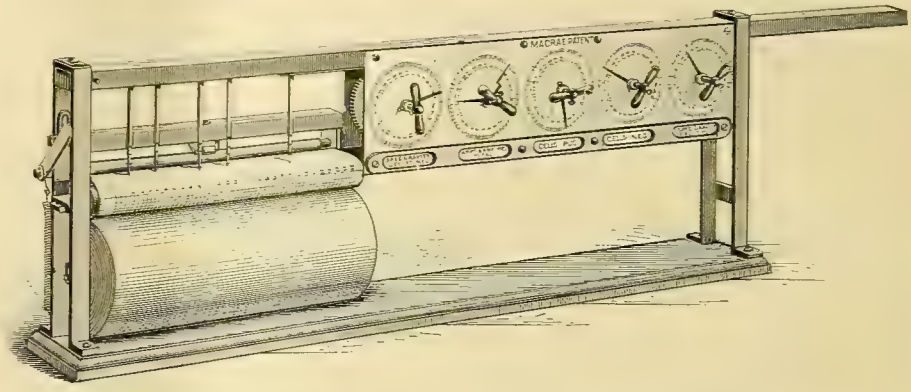


FIG. 1. MACRAE CURVE TRACER AND CURVE INTEGRATOR.

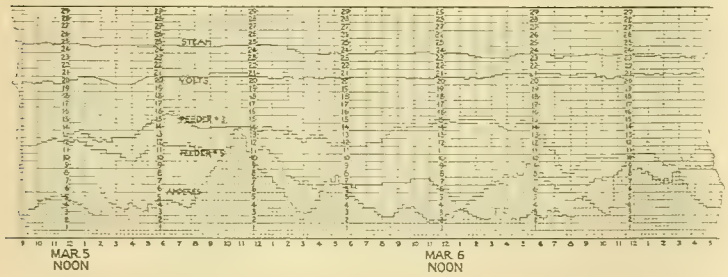


FIG. 2. MACRAE CURVE TRACER AND CURVE INTEGRATOR. TYPICAL RECORD.

Fig. 2 shows a typical record kept by means of the Macrae apparatus.

This device is manufactured by the Crescent Electric company of Baltimore.

LINEMAN'S CLIMBING SPUR.

Lineman's Climbing Spur.

The familiar implement herewith illustrated is made by Mathias Klein & Son of Chicago. It is of the style usually known as the Eastern climber in contradistinction to the Western climber or hook. The rapid development of the electrical industries, especially the telegraph and telephone, and the naturally itinerant occupation of linemen brought Eastern linemen to this section, and vice versa, and have had the result of introducing this spur in the West, and inducing Mathias Klein & Son, the manufacturers of linemen's tools, to give this style of climbers their attention.

By embodying the results of a long experience in the manufacture of this line of tools with the valuable suggestions from the men using them, they are producing climbers which have gained for them an enviable reputation. All tools put out by them are stamped M. Klein & Son, and have a high standing.

Transformer Economy.

[*Continued from page 47.*]

answer, as it depends so much on the conditions of operation and on the locality. In a great many, perhaps the majority, of alternating-current stations at present in operation in this country, the old transformers first purchased, the original installations, are still working. The first stations were installed in the early part of 1887, and some in the latter part of 1886. A large proportion of those transformers are still in operation, showing that their life has not ended. A great many, however, have been destroyed by lightning and the causes which Professor Goldsborough has called our attention to, and the number of transformers destroyed by lightning may in many cases be a large percentage of the transformers installed during the last 10 years. It depends on the conditions of the line and the methods of protection of the line, so that there is no reliable basis for estimating the life of transformers. It must be understood that the transformers made to-day have a much longer life than the transformers made 10 years ago, when the industry was in its infancy (the alternating-current industry), so that it is a very difficult question to answer. The depreciation of a modern transformer would not be greater than 10 per cent. I imagine it would be less than that, at least not as great as the depreciation of the generating apparatus, which is usually taken at about 10 per cent.

E. V. Matlack, St. Louis: Our experience has been, with the lightning arrester, that we receive at least as many discharges on motors comparatively isolated on top floors of buildings, where there is no possibility of discharging to the ground, as we do on motors in the basement. The discharge is between the wires, and not necessarily to the ground. Most of our trouble has been with machines perfectly insulated from the ground. There are no indications of discharges to the ground.

W. McLea Walbank, Montreal: I should like to ask the relative life of transformers cooled by oil and by the air-blast type.

Professor Goldsborough: I am not entirely prepared to answer that question and give any definite information. Where good oil is used the advantage is largely in favor of oil-insulated transformers. There is much greater opportunity for the unoiled transformer to deteriorate rapidly over and above a transformer insulated with good oil; but if the oil contains impurities, is of low quality and will not stand a high insulation resistance test, it may be that the oil would be more detrimental than beneficial. There are many things that enter into this problem, and I should say that it should be made a matter of some standard rating by test, so that we could compare transformers made by different companies. The question has been asked regarding the time of scrapping. It is hard to define a limit. I made no effort to make matters worse in this paper than they are. I simply wish to give you in this paper a fair statement of things as they exist to-day, what you are likely to meet with, and not something that happened last year or the year before, in which the conditions are much exaggerated. We have had transformers in our laboratory in which the core losses would run up so fast that they had better be thrown away. That is no longer the case, and we are getting better transformers. We have had modern transformers which will increase their age-loss 20 per cent. in a year. Should we scrap that transformer at the end of the year? It depends on what the power is worth, and it is a matter of dollars and cents which should be figured by each central-station manager in regard to his own plant. If it costs one cent to develop power and you sell it cheaply, it is not so important. If the power is expensive and you are selling it at a high rate, then the amount at which you can sell the power is of moment. If you have a transformer with high core losses it is simply using so much of the valuable energy of your station, and you have that much less to sell. You must look at it from the standpoint of the amount of coal which it consumes and also from the standpoint of the amount of reduction it introduces into the total available output of the plant, and the total income of the plant. It should be made a matter

of very careful study. You will hardly find two plants in which the conditions will be the same.

As regards the transformers manufactured to-day, I should say that in general with the transformers on the market the age-loss for a year will not be over 10 per cent. and in many cases not as much at that. I am rather inclined to doubt the claims that it will be less than one or two per cent. I have not had the pleasure of making tests on transformers so low as to their rate of ageing.

C. R. Huntley, Buffalo: In the operation of these tests have you discovered any tendency of the transformers to separate the oil?

Professor Goldsborough: The heating of oil takes place wherever a disruptive charge takes place. It is possible that there is a tendency for a separation to take place in the oil, in case it contains any appreciable amount of moisture; that is, if you place oil under heavy electrostatic stress, any moisture or foreign matter in the oil may serve to oxidize some molecules of the oil. That introduces a conducting matter at a weak point. The consequence is that that will act to start a disturbance in your transformer. If you have a weak point in insulation, or material of any kind, the whole strain tends to aggravate that weak point. I have not had an opportunity of testing oil under high voltage with any great detail, so that I am not prepared to make any decided statement covering that point. My experience has been that there is a condensation of the oil for every discharge that takes place, and there is probably a certain amount of that occurs before the discharge takes place.

Mr. Huntley: You favor an air-cooling transformer rather than an oil-cooling transformer with frequent carbonization of the oil?

Professor Goldsborough: You mean the insulation of the transformer by forcing through it large quantities of dry air?

Mr. Huntley: Yes, sir.

Professor Goldsborough: I believe perfectly dry air is as good insulation as we can find, and the next best is high-grade oil, free from any injurious matter.

Mr. Wagner: A company operating several plants in the West and having had a great deal of experience with high voltages, the Teluride Transmission company, has used oil altogether for the insulation of its transformers. It made an extended experiment on this line. Mr. Layman, I think, has some information about the results obtained by this company with oil and the effects of carbonization. There is one other question which is of considerable importance in the use of oil, and that is that it absorbs moisture. If you let it stand for a considerable time exposed to moist air or air at the ordinary temperature and the transformers are operated at intervals only and not kept continually in circuit, so that the oil is kept at fairly high temperature, they are likely to give some trouble from this cause in absorbing moisture. In many cases where transformers have been used for intermittent service, it has been found necessary at frequent intervals, according to the frequency with which the transformers go out of service, to draw off the oil and heat it to a high temperature, say 300 degrees, to expel the moisture, or replace it with other oil. As far as the carbonization of the oil is concerned, Mr. Layman can give you some definite information about it. Mr. Walbank asked the question, Which is the best means of cooling transformers, an air blast or oil? As Professor Goldsborough has said, dry air is as good an insulator as can be found, but air blown through the interstices of coils of transformers by blowers, as attempted in many cases, is likely to contain much dust, and that dust accumulates in the transformers, as it is drawn in by the currents of air and must be deposited when the velocity of the air decreases. I should imagine in time that dust would seriously affect the insulation, in the way of jumping across the air-gaps which are provided to prevent the high potential from jumping across.

Mr. Layman: Reference has been made to the Teluride Transmission company. That company carefully places its oil in condition for service. The oil as received may not be in condition for safe use. The company carefully eliminates all particles of dust or anything of that character from the oil and eliminates all the moisture, and it finds that there is a very slow but gradual improvement in the quality of the oil with heating. So far as the carbonization of the oil goes, the company finds no carbonization. In transformers which I have been watching for two years I made tests upon the oil when it was placed in the transformer cases and it is in there now. The fact of the matter is that if a transformer under ordinary conditions is allowed some ventilating space above the oil and no dirt gets in, the oil will improve in quality until there is a complete elimination of moisture. I think I agree with Professor Goldsborough in his statement that there cannot be too much care shown in the selection of oil.

Mr. Huntley: Do you regard the use of oil at all dangerous in the event of a burn-out in your transformer?

Mr. Layman: The characteristics of the oil have much to do with that. There are a number of grades of oil used in which the fire test of some is as low as 300 degrees, and in others 500 degrees. The danger from fire with the oil in a transformer is a slight one.

WAR NEWS.

Cable Communication with Cuba Under American Control.—With the fall of Santiago it seems to be certain that the United States is in control of all the working lines of cable by which the Spaniards in Cuba could communicate with their home government. Not only have the Spaniards lost all control of the sea, but they cannot communicate by telegraph either with Cuba or the Philippines save by the consent of the United States government. The cable office at Santiago will be under a strict censorship, of course, and nothing will be sent out that is inimical to the interests of the Americans. As a newspaper man expresses it, the army officers will edit Blanco's "copy"—if, indeed, the Spanish general can still telegraph from Havana to Santiago. Purely commercial messages will probably go without restriction, after approval by the censor. The era of cable-cutting expedients has probably passed, unless an effort should be made in the future to sever the cable connection between Spain and the Canary Islands. The sundered cables in Cuban waters will be repaired where necessary, and, with the control of telegraphic communication vested in the government, every effort will be made to encourage legitimate business.

The Dynamos Were Not Running.—In a reported interview with an officer of the Cristobal Colon, after the destruction of Cervera's fleet off Santiago, the value of searchlights in harbor defense is again shown. The officer was asked about the Hobson expedition, and in answer said: "We were much surprised, and at the first alarm believed that a torpedo-boat attack was going on. The shore batteries opened up and the ships used their rapid-fire guns. The dynamos were not going, however, and we had no searchlight, so that we could not find the object. We did not sink her with our batteries or our mines. She sunk herself with her own torpedoes by blowing out her bottom." This shows that the Spaniards were either desperately short of coal or else that they did not understand the value of the searchlight as an aid to modern warfare.

A Searchlight Display.—A farewell demonstration by searchlight was made on the occasion of the recent departure of the auxiliary cruiser St. Paul from New York. The Tribune of that city describes the scene: As the big liner went down the bay the band of the regiment was on deck playing. Half-way down the bay the big searchlight of the St. Paul shot out its long finger of light and swept across the bay, from Brooklyn to the Richmond shores. Then it was raised high in the air and waved slowly up and down three times. Almost like a flash came the answers. The searchlight of the cruiser Yankee picked up the St. Paul and held her. The lights of the two forts swung round from their ceaseless search of the Lower Bay and concentrated upon the cruiser. Then both forts began to signal by waves of their searchlights, and the St. Paul replied with hers. Then the masthead signals began to work, the colored lights on the forts replied, and the Yankee's light signals also began to flash. The red and white lights were kept going until the St. Paul was off Stapleton. Then she slowed down and held steerage way only. The forts had swung their searchlights over the Lower Bay again, and the red signals continued incessantly. After a 10-minutes' wait the searchlights of the forts swung back into the Upper Bay, and were waved up and down, and the St. Paul replied. The Yankee signaled "Good voyage," and her searchlight took up the St. Paul's stern. The St. Paul threw her searchlight directly ahead, and the two lights on the forts were thrown upon her sides. Thus, in a blaze of light, which illumined the whole lower part of the Upper Bay, the big steamer started to move again, swung into the channel and headed for the Narrows. As she passed the forts her big light swung in a circle, and the forts replied. The Yankee's light shot straight up into the air, and began to flash a parting signal. As the St. Paul was swinging under the guns to take the channel toward Sandy Hook the bombs at Manhattan Beach began to thunder, and, firing as they did, it seemed as if they were giving a salute. Once through the Narrows the big light on Sandy Hook picked up the cruiser, and with that on her bow and the lights of the inner forts astern, the St. Paul made her way down through the channel. It was one of the prettiest sights ever witnessed in the bay.

Removal of Harbor Mines.—Now that the danger of bombardment from Spanish warships has been removed, at least a portion of the mines protecting the Atlantic harbors will be removed. The work is under way at New York, but it must be done slowly and cautiously. It is impossible to say how long it will be before all the mines will be removed. The United States army engineers began laying mines in New York harbor late in April, and it was not until the last of May that all of them were in their places. It is estimated that it took six weeks to plant the mines. One of the engineers said that it was more dangerous to take up the mines than to put them down. There were less chances of exploding the mines in putting them down, because then the wires were new and not tangled; but when they had to be taken up some of the wires were twisted, and it worried the men a great deal trying to discover the proper wires. For that reason the men might be as long in taking up the mines as they were in putting them down. All of the mines and torpedoes that are found to be in good condition will be put in storage so that they may be put down again quickly should any such necessity arise. The men have instructions to blow up any torpedoes or mines which they do not think it safe to handle, but as there have been no violations of the harbor regulations lately by steam or sailing craft, it is expected that nearly every mine will be found in good condition. It is intended that the auxiliary appliances shall remain in position and that there shall be ready at each harbor the necessary mine cases, explosives, etc., so that mines to replace those removed can be laid immediately upon receipt of telegraphic instructions. In firing the mines the engineer officer in charge is requested to personally superintend the operation and to carefully observe the result in each case, so that the information gained, which will be of great value in future operations, may be carefully collated in the interest of the science of war.

The Scientific American states that during the thunder-storm of June 28th a bolt of lightning struck the switchboard at Fort Washington, which controls the mines in the Potomac River, exploding three of the mines and damaging the system. The mines were intended as a protection to the capital. The explosions were witnesed by a number of persons on shore and in boats, and the exhibition left no doubt as to the fate of any boat which may be near the mines when they are exploded. An investigation was at once begun to ascertain the extent of the damage.

War Tax on Telegrams.—Mr. N. B. Scott, the commissioner of internal revenue, in a letter to the Western Union company, says that the sender must provide the stamp for a telegram under the new law. He adds that the exemption of messages of the officials and employes of railroad companies, as provided in section 18, is strictly limited to the transmission of those messages between stations on the respective systems of railroads of the railroad companies. All dispatches or messages of railroad officials and employes sent from railroad stations on their respective railroads, and destined for places beyond their respective railroads, must be stamped by their makers, signers or issuers in accordance with section 7.

Another ruling has been made by the same authority regarding the use of leased telegraph wires. He holds that messages transmitted over a wire leased to any person, firm or corporation, over which the telegraph company exercises no control, relating exclusively to the business of the lessee, and for which no charge is made, are not required to be stamped. This ruling affects railroad companies, brokers and business men operating leased wires, and newspapers who lease wires for the transmission of news.

However, it is possible that the Illinois Manufacturers' association may try conclusions with the telegraph companies. A test case may be brought against them to decide whether the companies or the customers be required to furnish the revenue stamps affixed to telegrams.

Flag Raising at Fort Wayne.—What is said to be the largest flag in the state of Indiana was raised in the presence of a great concourse of spectators over the works of the Fort Wayne Electric corporation on July 16th. There was a searchlight display, and on an arch connecting the office and factory buildings the words "Fort Wayne" were shown in large letters of incandescent lamps. When the flag was actually hoisted the strong light of two searchlights was thrown upon it. The flag and a surmounting eagle were presented to Mr. McDonald by the employes of the company. Mr. McDonald was unavoidably detained in the East, however, and Mr. J. J. Wood, the electrician of the company, accepted the flag in his behalf. Mr. E. A. Barnes, the acting superintendent, made a presentation speech, Judge R. S. Taylor made an address, and there were patriotic music and cheers and fireworks.

The equipment, as described by the Fort Wayne Gazette, is erected on the northwest corner of the factory, where the walls are of sufficient strength to withstand the strain. The pole, eagle and flag, mounted in position, have an aggregate weight of 3,500 pounds. The pole is clamped to the corner of the building with heavy wrought-iron clamps, and its construction is unique, the center being composed of wrought-iron pipe varying from 4½ inches in diameter at the base to 1 5-16 inches in diameter at the top. This pipe not only acts as the backbone of the pole, but at its lower end is connected to earth so as to form a lightning rod. Running through it are the copper conductors which furnish current to the lights suspended from the eagle's beak. The pipe is covered by segmental pieces of wood which are held in position by a serving of iron wire wound spirally over them. These, in turn, are covered by other segments of wood which form the outside of the pole. These are held in position with wire nails and screws, and after trimming to the finished size, 13 inches square at the base to six inches in diameter at the top, are again wound with galvanized steel wire three-sixteenths inch in diameter with a tensile strength of 2,000 pounds. From this construction it will be seen that

the pole is not only exceedingly strong but very pliable, and could be bent like a bow without any danger of breaking. It extends above the building 102 feet in the clear, no guy wires or additional supports being needed. The golden eagle which surmounts the pole stands on a 12-inch sphere and holds in its beak a six-inch golden ball from which project the national colors composed of three red, white and blue 50-candle power electric lamps. The eagle and its equipment weigh 50 pounds and stand six feet high. The emblem has a spread of six feet six inches from tip to tip, and stands 150 feet above the sidewalk. The flag is 54 feet six inches long and 32 feet six inches wide. The stripes are each two feet six inches wide, while the total weight of bunting used in its construction is 60 pounds.

The Signal Service.—Capt. J. W. McConnell of Chicago has been made the captain of the company of regular signal men formerly commanded by Major Glassford, who is now the chief officer of the entire signal corps at Camp Thomas. This transfer leaves Captain Inman of Springfield in charge of the Illinois contingent, and makes a distinct promotion for both the Illinois men. The following first-class privates in the Signal Corps from Illinois have been promoted: To be first-class sergeants, A. H. McNeil, S. W. Wooster, John S. Cessna and C. S. Hotchkiss; to be sergeants, D. F. Delahunt, J. W. Konigsmark, D. N. Williams, C. E. Sherwood, O. A. Phelps, John M. Scott, Harry S. Deacon, J. H. Irwin and Frank I. Guest; to be corporals, R. S. Gill, A. R. Hutchinson, W. F. Otto, J. J. McClure, P. A. Johnson, E. O. Baker, J. W. Labertow, Thomas Best and A. L. Farankinburger. The heliograph practice of the men at Chickamauga has been especially satisfactory. Major Glassford some time ago demonstrated that heliograph telegraphing could be made successful at a distance of 183 miles. It consists in focusing the rays of the sun on a given point, much after the manner of using a searchlight, only with the heliograph French plate mirrors are used. Then with a shutter the sun's rays are cut off and projected, and the receiving station takes the message by dots and dashes just as a telegrapher does. The men have become as proficient in this branch of the service as they have with the wig-wag flags, and can talk to one another by the flash system almost as fast as men do by modern telegraphy.

Good Work of the Floating Machine Shop.—The steamer Vulcan of the navy, fitted out as a repair ship by Engineer-in-Chief Melville, has already proven invaluable to the large squadron in Cuban waters, operating far from a naval base, where repairing would be impossible, except in the case of exceedingly slight injuries. It is now clearly shown that had not this vessel been promptly sent to Santiago a number of warships would have had to continue in crippled condition or been returned to the United States to put in good order. A letter received recently from Chief Engineer Chasmar of the Vulcan, dated Guantanamo, July 5th, declares the Vulcan is thoroughly appreciated in the squadron and is doing great work. Twelve ships have already made use of her facilities for repairs to their machinery, and several of them received new steam pipes in place of the old ones that had been shot away. The Vulcan has not been limited, however, to steam engineering affairs alone, but has been used for ordnance and construction work. She has remedied the damages to the hull of Commodore Watson's flagship, the Newark, caused by collision with the Dolphin, and among other odd jobs two shafts for six-inch gun mounts, essential to the use of those weapons, have been made in her shops. The Vulcan has blacksmithing, machine-shop, boiler-making and other complete outfits aboard that permit work of any reasonable magnitude to be undertaken, superior to the capacity of shops at many small ports and surpassed alone by the larger navy yards.

Miscellaneous Notes.—Theodore W. Miller of Company D, Rough Riders, who was killed at Santiago, was a brother of Mrs. Thomas A. Edison of Orange, N. J., the wife of the inventor. He was only 23 years old and the son of Lewis Miller of Chautauqua fame.

A new government cable has been laid between Rock Island and Narragansett Pier. The cable was laid by order of Secretary of War Alger, and at Narragansett connects with the Providence Telephone company's line, thus giving direct long-distance communication from Block Island to New York and Washington. While it will be open for public service, primarily it will be used for the government signal service, and for the first time will establish direct connection with the signal-service stations along that coast.

A dispatch sent from Tampa last week stated that a gas plant was being completed by the government there. The work is in charge of Major Reber, who is attached to the Signal Corps. Gas will be made in Tampa and placed in cylinders and sent to Cuba for use in the balloons, it having been determined that this can be done better than by taking the gas plant to Cuba. Besides the big 30-foot observation balloon a number of small balloons are to be sent to the army. These are not for observation, but for signaling.

While in Tampa last week General Greely, chief signal officer of the army, inspected the work of the Signal Corps attached to the Fourth Army Corps and expressed himself as highly pleased with the work of the officers and men. He had nothing save commendation for Captain Jasper E. Brady, who has filled the somewhat thankless position of censor for the last two months, and incidentally he announced that the censorship would be relaxed at once so that it will be possible for newspaper correspondents to send reports of everything that has occurred. Only the future movement of troops and warships and criticisms of the government and army and navy officials will hereafter be prohibited.

In one of the blockhouses on the ridge between Baiquiri and Santiago the invading Americans found a telephone. It was still in working order, so far as the battery was concerned, but the humorists who sought to call up Santiago could get no response to their repeated ringing of the bell. This telephone line between Baiquiri and Santiago, like the water supply of these small outlying towns, is a result of the presence of American companies at the mining towns of Baiquiri and Juragua, whence iron ore is exported.

"We read with much gratification that 'the last cable connecting Santiago with the outside world' has been cut again," says the Chicago Chronicle, and it adds: "As we remember it this is the 1,787th time the feat has been performed and the fact bears high testimony to the activity of our small cruisers. To pick up and cut four or five times a day a cable which promptly reunites itself is a job which requires patience and good temper. Yet none of our mosquito fleet commanders has shrunk from the task. When other business—in the line of bombarding batteries or knocking down blockhouses—has been dull the Winslow or the Hornet or the Wampatuck would steam in shore and cut 'the last cable' in a few places. And within five minutes Brother Linares would be ticking away to Mr. Sagasta—over that same cable—an account of another glorious victory over the Yankee pigs. It is a good thing that this cable has been cut again and we hope that our bluejackets will keep on cutting it. A cable which persists in working after it has been cut up into three-foot sections is clearly contraband of war and deserving of no consideration. Let the chopping proceeded with unabated vigor.

Electric Railway Litigation.

The Walker company asserts that its present method of motor suspension for electric-railway cars is not the same as that adjudged to be an infringement of the Sprague motor-suspension patent by the United States Circuit Court of Appeals. It has issued a circular illustrating its present method of motor suspension and also the principle of the Sprague method. This circular was issued in answer to a circular letter of the General Electric company containing these statements:

"In pursuance of the decision of the court, from which no appeal can be taken, the Walker company is now under injunction, by the terms of which it is forbidden from 'directly or indirectly, making or causing to be made, using or causing to be used, or vending to others to be used, or disposing of in any way any apparatus or structure containing or embodying the subject matter of the combination' of the second and sixth claims of the Sprague patent No. 324,892, or either of those claims, which are as follows:

"'2. The combination of the wheeled vehicle and an electro-dynamic motor mounted upon and propelling the same, the field magnet of said motor being sleeved upon an axle of the vehicle at one end, and supported by flexible connections from the body of the vehicle at the other end, substantially as set forth.

"'6. The combination with a wheeled vehicle supported upon its axles by springs, of an electro-dynamic motor flexibly supported from such vehicle and centered upon the driving axle thereof, substantially as set forth.'"

The Walker company contends that, according to the specifications of the Sprague patent, the motor was journaled to the axle rigidly and supported on the opposite side by spiral springs attached to a cross-bar resting on the side-bars of the truck. It is claimed that the present Walker suspension is entirely different, as the motor itself is not journaled to the axle, but has its weight suspended directly over the axle by spiral springs. It is claimed that these springs take up all of the jar and hammer blow exactly at the point where it will do the most good. "The nose of the Walker motor at that side of the motor farthest from the axle," explains the company, "is supported rigidly upon a cross-bar which is attached to the side bar of the truck. This rigid suspension is of great value, as it keeps the motor from rapidly oscillating up and down during the acceleration and braking of the car. One of the main objects of this method of suspension is to prevent this oscillation, which so often breaks and wears out the cables passing from the car body to the motor."

It is claimed to be the opinion of "the most learned patent counsel of this country" that this form of suspension does not infringe any of the patents controlled by the General Electric company. This is, of course, the important point, and it is one of much interest to the electric-railway companies of the country.

The General Electric company calls attention to the fact that decree and injunction have issued against John G. Buehler, Frank H. Platt and the Columbia Machine Works for infringing on the Van Depoele patent No. 424,695, entitled "Improvements in Suspended Switches and Traveling Contacts for Electric Railways." This patent was upheld by Judge Wallace in 1896, in the suit brought by the Thomson-Houston Electric company against the Elmira and Horseheads Railway company.

Bourgogne Victims.

Mr. and Mrs. Anthony Pollock, the patent attorney and his wife of Washington, who were victims of the Bourgogne disaster last week, left an estate valued at nearly $750,000. The greater part of it goes to Mrs. Pollock's nieces in Paris, whom the Pollocks were on their way to visit when the ship was lost. A number of bequests to personal friends were made in the will. Mr. Pollock was the oldest patent attorney in Washington, and was recognized as a leader of that branch of the bar. He represented before the Patent Office several of the largest corporations in the country, and had been associated with many of the most notable patents that have been issued during the present generation, particularly in electricity. He filed the original application for the telephone, and had been a valued adviser of the Bell company through all the litigation in which it has been involved. He was also the attorney for the graphophone. Mr. and Mrs. Pollock belonged to the most exclusive Washington society, and their residence was one of the finest in the city. No family at the capital entertained more extensively or elegantly. Mr. and Mrs. Pollock had no children. Their nearest heirs were Mrs. Pollock's nieces in Paris, whom they were in the habit of visiting every summer. They had crossed the ocean on the French line every year as long as any of their friends can remember. According to William E. Curtis, the Washington correspondent of the Chicago Record, the only information that has been received of their fate came from one of the first-cabin waiters, who was saved from the wreck and was seen in New York the other day by Mr. Pollock's partner. He reports that shortly after the collision he saw Mr. and Mrs. Pollock coming up the main companionway of the steamer with life preservers strapped around them. Mrs. Pollock was very pale and her husband was trying to quiet her alarm. He heard the captain give them an assurance that the vessel was in no immediate danger and would certainly remain above water until he could reach Cape Sable, which, he said, was 60 miles away. Mr. and Mrs. Pollock accepted this assurance in good faith, and when last seen were standing with their backs against the pilot house watching the struggles of the other passengers to reach the boats. Shortly afterward the waiter says a heavy wave swept over the bows of the vessel and probably carried Mr. and Mrs. Pollock overboard.

E. A. Angell of Cleveland was another victim of the Bourgogne disaster. Mr. Angell was a patent attorney of standing in his profession, and only a few weeks ago was taking testimony in Chicago in the patent suit of the Western Electric company against the Williams-Abbott Electric company of Cleveland. Mr. Angell represented the defendant, which is charged with infringing the patent on the Gray automatic cut-out for telephone call boxes. While in Chicago Mr. Angell spoke with enthusiasm of his coming vacation trip abroad. He was going to meet his wife and children in Europe, but he met death instead. Mr. Angell graduated from Harvard in 1873 and was a classmate of the late Henry B. Stone, for several years the representative Bell telephone man of the West. F. P. Fish, the distinguished patent lawyer, was in college with Mr. Angell, graduating a year later. Mr. Angell studied law, was admitted to the bar and engaged in general practice. Of late years he did considerable patent work.

Failure of Edward Baggott.

Edward Baggott, the plumber and gasfitter of Chicago, confessed judgment last week before Judge Gibbons for $22,243, principal and interest on four notes for $5,000 each in favor of the L. Wolff Manufacturing company and secured by a trust deed given to John Lewson. The levy was made upon stock at 163 and 171 Adams street and 228 shares of Chicago General Fixture company's stock, valued at 22,800. Mr. Baggott made a voluntary assignment to the American Trust and Savings Bank as assignee. The assets are estimated at $300,000 and liabilities at $125,000, including the notes on which judgment was confessed. The preponderance of assets over liabilities is admitted, and slow collections is the only reason given for the collapse. Mr. Baggott is favorably known among the electrical men of Chicago and throughout the West, as he has been a dealer in electric fixtures on an extensive scale.

Suburban Electric Road.

Within a year it is proposed to build and operate a trolley line between the western limits of Chicago and the village of River Grove. The new road will be 10 miles long and the company will be known as the Northern Electric Railway company. The county board was asked last Monday for a 50-year franchise for the road. The new road, it is said, will be a part of the Yerkes system. It is probable that the Grand avenue line will be extended to meet the River Grove road.

CORRESPONDENCE.

New York Notes.

New York, July 18.—The old subject of the overcrowding of street cars is up again, and Mr. Christman has introduced an ordinance in the City Council limiting the legal carrying capacity of a street car to its seating capacity. President Vreeland of the Metropolitan company, in an interview on the subject, takes a sensible view of the matter, and says that if the public will accept the change his company will gladly do so. He points out that the present unsatisfactory state of affairs is due to the topography of Manhattan Island and says, in effect, that the remedy proposed is worse than the disease, as would soon be discovered during the rush hours on a stormy night if passengers were compelled to stand on street corners and watch perhaps a dozen cars go by bearing the "Full" placard. People would prefer some discomfort inside the cars to the greater discomfort and delay outside. Mr. Vreeland states that in Broadway, in the busy part of the day, cars are run on a six-second headway and that it is impossible to run cars closer together. He puts the case very clearly, and I regret that his interview is too long to quote entire. One extract must suffice: "A month ago I issued an order which is still in force, instructing conductors when the car was full to take no more passenger aboard. What was the result? Magistrate Meade, from the bench, and numerous editorials in the leading newspapers, have abused us because conductors, when their cars were full, would not stop when signaled by passengers. Then, again, when the cars are obliged to stop to let passengers off, other people seize the opportunity to push themselves aboard when it is perfectly apparent to them that there is only standing room. What is the conductor to do in such a case? Now in those cities in Europe where a car or a bus is restricted to carrying only so many persons as can be comfortably seated, the law imposes an obligation upon the passenger as well as the company. A person is obliged, under penalty of a fine, to take his turn, and is not allowed to push his way into a vehicle that already has its seats filled. Apparently Mr. Christman's resolution places no such duty on the passenger. It merely provides that if a passengger cannot get a seat he shall not pay his fare—in other words, he gets a free ride. This will encourage him, rather than deter him, from mounting a car that exhibits a notice stating that it is full. A conductor could not be expected to throw all the passengers off a car who could not find seats, and certainly in the case of open cars it would be impossible to prevent people from climbing aboard. Let Mr. Christman place some of the obligation of carrying out this law upon the passengers, and we shall be satisfied. I confess I can see no adequate remedy to do away with the overcrowding, but if Mr. Christman or anyone else can suggest one that will be effective and practicable this company is ready to act on it. I think that the congestion of the Broadway traffic will be considerably lessened when the new electric lines along Sixth and Eighth avenues are completed. We expect to have them both in operation from the Astor House to Harlem by September 15th."

By an arrangement between Comptroller Coler and the Jamaica Electric Light company the street lights in that suburb are again illuminating the highways. The bills of the company will be paid.

The house of George Moran on Sixth street, Greenport, Long Island, was struck by lightning in a heavy storm a few days ago. Mrs. Moran was alone in the house at the time, and was made partially unconscious. The building was badly shattered. A bolt that struck the piazza tore away one of the pillars, and entered the bedroom through the side of the house, tearing away the clapboards. A bedstead was demolished, and the plaster from the wall lay in heaps about the room. Another bolt struck one of the poles of the New York and New Jersey Telephone company, in the yard, and completely splintered it. George Cleaves, surveyor of the port, was writing in his office in Main street when the storm broke out, and received a slight shock. The wires of the telephone company were useless for some time after the storm, and communication with outside villages was cut off.

M. S.

PERSONAL.

H. L. Edgar of Boston has been in Chicago several days.

Luther Stieringer of New York stopped in Chicago early in the week on his return from Yellowstone Park.

Max A. Berg of Mansfield, Ohio, well known to many persons in the electrical supply business, was in Chicago recently on his vacation.

ELECTRIC LIGHTING.

The new arc-lighting plant of the city of Chicago at Rice and Lincoln streets has been put in operation. It will have an ultimate capacity of 1,000 arc lamps of 2,000 nominal candle power each.

The lighting of the streets of Quito, Ecuador, has been undertaken by a native company, and is well advanced. A complete plant has been brought from the United States to Ecuador, with an electrician to carry on the work.

ELECTRIC RAILWAYS.

A trial order of 12 sets of motor equipments has just been placed with Messrs. J. Stone & Co. of Deptford, England, by the Cape Government Railways, to be followed by a general introduction of electric-railway apparatus should the experiment prove successful.

POWER TRANSMISSION.

The directors of the Nevada County Electric Power company have called a meeting of the stockholders of the company to be held in the office of the company in San Francisco on August 16th to consider the proposition of a $300,000 six per cent. 30-year bond issue. It is proposed to redeem the outstanding bonded indebtedness of $200,000 out of the proceeds of the sale of the new bonds, applying the remaining $100,000 to increasing the capacity of the plant. Increased business makes the extension desirable.

ELECTRICAL SECURITIES.

A receiver has been appointed for the Staten Island Rapid Transit Railroad company.

The Detroit Citizens' Street Railway company reports gross earnings in the first six months of 1898 at $553,974, and in the first six months of 1897 at $510,222, being an increase of $43,752.

The Metropolitan Street Railway company of Kansas City reports gross earnings for the first six months of 1898 at $996,700, as against $981,410 in the first six months of 1897, being an increase of $14,290.

The New England Telephone and Telegraph company of New York city has filed a certificate of an increase in its capital stock from $12,000,000 to $15,000,000. The debts and liabilities of the company amount to $3,505,404.

The assets of the Kings County Traction company have been sold at auction in accordance with the terms of an agreement entered into over two years ago between the Nassau Electric Railroad company and the Brooklyn Traction company, and was preliminary to the winding up of the traction company affairs. The purchaser is D. E. H. Harriman for the syndicate, and the price paid was $2,100,000.

For the quarter ended June 30, 1898, the gross earnings of the Metropolitan Street Railway company were $3,230,763; operating expenses, $1,628,659; net earnings, $1,602,104; fixed charges, $1,101,280; surplus, $500,824; dividends, $375,000; balance, $125,824. A meeting of the stockholders of the company has been called for August 9th to authorize the issue of $15,000,000 in new stock, of which $10,000,000 is to be sold at once to the stockholders at par and the other $5,000,000 will remain in the treasury. The new issue will increase the capitalization of the company from $30,000,000 to $45,000,000.

The deal by which the entire stock of the Edison Electric Illuminating company of Brooklyn is to be bought by the Kings County Electric Light and Power company has been finally concluded, according to advices from New York. Edison stockholders will have the right to subscribe for 25 per cent. additional stock at par under the terms of the agreement. The increased holdings are then bought at par by the absorbing company, payment being made in 90-year six per cent. mortgage bonds, secured by all the Edison stock, held in trust, a junior lien on all the property of the Kings County company and a cash guaranty fund of $1,000,000.

MISCELLANEOUS.

The London General Omnibus company has, it is stated, entered into a contract to put 400 electric omnibuses on the streets of London within the next few months.

It is said that the copper mines of Arizona are producing about 9,500,000 pounds of copper every month. In addition the mines of Globe, soon to be reopened, will contribute about 1,500,000 pounds monthly to the output.

TRADE NEWS.

The Mutual Electric company has opened offices at 1218 and 1210 Marquette building, Chicago, to do a general electrical construction business.

In collaboration the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing company have issued another trade pamphlet—this time on "Electric Mine Haulage." The electric mine locomotives turned out as the joint product of the two companies are briefly but clearly described and illustrated. It is needless to say that apparatus bearing the combined names of Baldwin and Westinghouse must have the stamp of excellence.

One of the largest and best equipped power buildings in the United States is the Manufacturers' building, Providence, R. I. This building has accommodations for upwards of 60 manufacturing concerns, being particularly equipped with conveniences for the production of jewelry, specialties, etc. The Manufacturers' Building company has just purchased a 250-kilowatt 500-volt Westinghouse engine-type generator, to be operated at 100 revolutions per minute, and driven by an Armington & Sims Corliss engine. This generator will supply power for the operation of motors in the various manufacturing departments of the building. The engineering features of this establishment are under the direction of Lewis & Claflin, consulting engineers.

In presenting the 1898 edition of its useful pamphlet, "Graphite as a Lubricant," the Joseph Dixon Crucible company of Jersey City announces that it will send a copy of the work as well as samples of graphite to anyone interested in better lubrication. Under the heading, "Lubrication of Gas Engine Cylinders," it is mentioned that an officer of the Pennsylvania Railroad company used finely pulverized graphite for lubricating a gas engine, with most marked results in the way of better lubrication—and in the saving of what would have been in his case a $75 expense. Special mention is made of a hand oil pump. This method of lubricating engine cylinders is not new, but it has been found that a small hand oil pump is one of the most efficient devices for introducing oil or graphite just where it is wanted.

The electrical trade in general will be interested to know that there has just been organized in Cleveland, O., a new electrical manufacturing company under the title of the Cleveland Electric company. This company was organized about July 1st, with officers as follows: President, W. J. Morgan; vice-president, F. C. McMillin; treasurer, O. P. Fisher; secretary, N. C. Stevens; general manager, Frank A. Rogers. The Cleveland Electric company is capitalized at $75,000, and it will manufacture all kinds of novel electrical appliances. At present the company is marketing its very ingenious automatic "cut-in and cut-out" time switch, an arc cutout with many novel features, and also quick-break knife switches and head blocks. The company's factory and office are located in the Marine building, 14 and 16 Middle street, Cleveland. President W. J. Morgan is well known in Cleveland and, indeed, throughout the United States, as the president of the W. J. Morgan Lithograph company, one of the largest of its kind in the country; Vice-president F. C. McMillin is one of Cleveland's well-known lawyers; Treasurer O. P. Fisher is also secretary and treasurer of the Garfield Banking company; Secretary N. C. Stevens was formerly connected with the Toledo Electric Light company; General Manager Frank A. Rogers needs no introduction to electrical people, having been so long and favorably known throughout the United States as general manager of the Card Electric company of Mansfield, O. With such a coterie of well-known business men, to say nothing of having the services of so experienced a man as Mr. Rogers as general manager, it is apparent that the Cleveland Electric company starts under the most favorable auspices.

BUSINESS.

The system of belt power transmission advocated by the L., P. & D. Transmitter company of Montpelier, Vt., is illustrated by a new catalogue, which will be sent free of charge to anyone interested. This system is a great space-saver and in many cases is very valuable.

An ingenious mechanical advertisement, by which any patriotic citizen can punch a Spanish face to his heart's content, is distributed by the National Automatic Fire Alarm company of 618 Gravier street, New Orleans. This company deals in electrical supplies of all kinds.

The Garlock Packing company of Palmyra, N. Y., reports that many engineers complain to it that other manufacturers imitate the Garlock boxes and labels. The Garlock packings for steam, water, gas and ammonia are put up in boxes having a yellow label, with a trademark printed in red.

The Ball Engine company, Erie, Pa., has recently received orders for several engines from Mexico. It is also noted that the Adrian Water company, Adrian, Mich., is about to increase its electric plant by the addition of a tandem-compound engine now building by the Ball company.

In addition to carrying a large and well-assorted stock of the celebrated loricated conduit for interior wiring, the Central Electric company of Chicago announces that it has full and complete lines of all sizes of circular-loom conduit and plain brass and iron-armored interior conduit, and all fittings.

The American Circular Loom company (represented in Chicago by George W. Patterson at 1539 Marquette building) reports business very good, especially in the month of June, while the reports for April and May show double the sales of the corresponding months of last year. Possibly some of this business is due to the good feeling generated by the souvenir pipe given out at the National Electric Light convention. Owing to the great demand for the company's electroduct tube in the East, it has only lately been able to spare any for the western market. The point of special merit claimed for this steel conduit is its absolute freedom from internal scale, which is removed by the process of redrawing or drawing down the pipe over a die. This method is used only by the Boston Electroduct company, and is a great improvement over the pickling or sand-blast process, which never, it is asserted, removes all the scale, and that remaining is apt to come off when rough-braided wires are drawn in,

leaving a spot which quickly rusts from condensation of moisture, soon ruining the insulation of the wire.

The Electric Appliance company has just issued a neat circular of electrical house-goods specialties for which it is general western agent, giving particular attention to the Noxall annunciator, showing in detail the construction and operation of the machine, etc. The Electric Appliance company will be pleased to send a copy of this special circular and price-list to anyone in the trade who has not received it.

The Jandus enclosed alternating arc lamp is being largely ordered for central-station work. For stores, churches, halls, etc., it is claimed to be especially adapted, as it burns steadily and without noise for a period of 80 to 100 hours without trimming. The light is soft and pleasant to the eye. The "Midnight Sun" booklet tells all about it. The Chicago office of the Jandus Electric company is at 753 Monadnock building.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 12, 1898.

607,007. Apparatus for Manufacturing Ozone. Emile Andreoli, London, England. Application filed October 15, 1897.

An ozonizer is built up as follows: An electrode consisting of a series of metallic strips having serrated edges, the strips being placed face to face in a row, and supported by rods passing through and mechanically connecting them together, a dielectric located opposite each set of serrated edges, a plate of wood or similar non-conducting material opposite each dielectric, the plate of wood provided on its opposite faces with a thin metallic layer constituting an electrode of opposing polarity to that first named, and so on, thus forming a series or plurality of ozonizers into a compact structure.

607,018. Underground Electric Conduit. Thomas Connelly, Chicago, Ill. Application filed November 12, 1897.

A conduit is composed of a series of tubes laid coaxially, the tubes being chamfered on their ends, and an unbroken, corrugated, metallic ring over the joints, for holding the tubes in line.

607,036. Electric Controlling Apparatus for Switch Valves. Elmo G. Harris, Rolla, Mo. Application filed September 25, 1897.

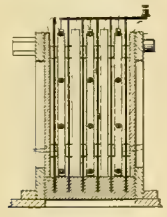
A switch valve controls the admission and discharge of water and air to and from the tank, oppositely acting solenoids controlling the position of the switch valve while a battery or other source of electricity supplies current through each of the solenoids to suitable contacts adjacent to the vessel or tank, and an arm controlled by floats in the vessel or tank engages one of the contacts when the vessel or tank is substantially empty, and the other when it is full.

607,070. Electric Cable for Driving Conveyances. Addison Norman, Toronto, Canada. Application filed April 19, 1897.

An electric cable consisting of continuous positive and negative conductors, insulating material between and surrounding the conductors, and a switch for each conductor attached to and surrounding the cable.

607,078. Electrode Plate of Electric Accumulators. Paul F. Ribbe, Berlin, Germany. Application filed January 25, 1898.

An electrode plate comprising a lead plate, having openings, the celluloid bars on each side of the plate and connected together through the openings thereof, the bars having undercut edges and the active material held thereby.



NO. 607,007.

607,093. Electrically Heated Roll. Fred P. Snow, Lynn, Mass. Application filed May 3, 1897.

An annular core, wound with a primary conductor, and contained in a rotary shell, which forms the choking portion of a secondary circuit about the same core.

607,124. Automatic Cutout for Secondary Batteries. Walter L. Negbaur, Brookline, Mass. Application filed February 19, 1897.

An automatic electric switch comprising a magnet core is provided with a non-polarized armature, a working circuit controlled by the armature and two coils on the magnet core wound and connected to oppose each other, the armature being operated by the differential effect of the coils.

607,125. Method of and Apparatus for Generating Electricity. Walter L. Negbaur, Brookline, and Joseph J. Feely, Walpole, Mass. Application filed June 17, 1897.

The method described of generating by a dynamo electricity of practically constant pressure from a source of variable motion consists in opposing to the generated voltage an independent, steady voltage, and automatically keeping the difference between the two voltages within narrow limits by impressing it on a circuit of low resistance and causing the resulting current to vary the magnetic conductivity of a magnetic shunt around the armature of the dynamo.

607,176. Electric Break for Induction Coils. Thomas B. Kinraide, Boston, Mass. Application filed February 26, 1897.

A high-speed break, comprising a coil and its core, an anvil in electric circuit with the coil, a standard supporting the anvil, and a vibrating hammer in and interrupting the circuit and vibrating between the core and anvil, combined with means to prevent compound vibrations of the anvil and hammer.

607,177. Electric Break and Induction Apparatus. Thomas B. Kinraide, Boston, Mass. Application filed July 26, 1897.

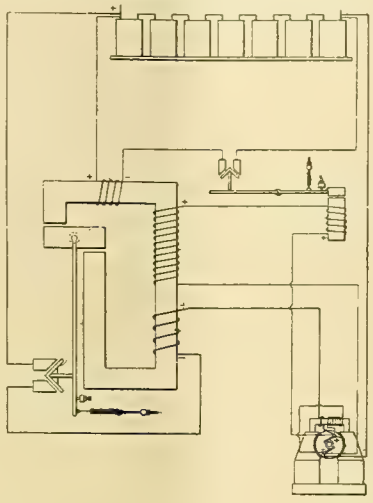
The method described of operating an induction apparatus in a system including the induction apparatus, an interrupter, condenser, and source of electric energy, consists of energizing the induction apparatus from the source of energy in connection with the condenser, and when the wave is at its extreme fluctuation, cutting out the condenser.

607,185. Electric Meter. William D. Marks, Philadelphia, Pa. Application filed November 4, 1897.

A maximum load or ampere indicator co-operating with electric meters, comprising a shaft, connections between the shaft and the meter by which the shaft will be turned in one direction only, and a supplemental finger connected to the shaft and co-operating with a scale.

607,194. Trolley. William H. Russell, Chicago, Ill. Application filed May 24, 1897.

The combination with a trolley arm or pole of a base, comprising a tubular portion fitting over the trolley arm or pole, a flaring portion extending from such tubular portion



NO. 607,124.

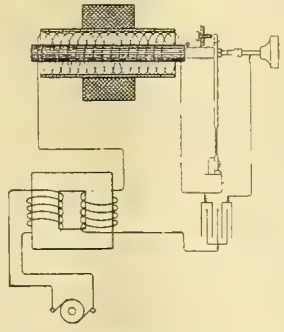
upward and outward and a table at the upper end thereof, and a fork having a trolley wheel rotatably mounted therein, such fork comprising a tubular portion fitting over the table on the base, a pivot extending, in a vertical plane, through such fork and base, an arm on the under side of the fork, extending under the base, and a spring on the trolley pole engaging with such extension.

607,233. X-Ray Apparatus. Henry Green, Hartford, Conn. Application filed September 30, 1896.

A fluorescing lamp is located in a circuit within a cabinet and in juxtaposition to the ray-penetrating plate; two relatively shiftable contact members are located in the circuit; coin-controlled mechanism for shifting the contact members into and out of contact with each other; and a fluoroscope mounted on the cabinet and having an X-ray penetrating screen in juxtaposition to the ray-penetrating plate of the cabinet are provided.

607,239. Telegraph. Leo W. Hildburgh, New York, N. Y. Application filed June 2, 1897.

A main line and a source of alternating current are provided with means for controlling the flow of the positive and negative impulses from the generator by short-circuiting one set of impulses at the time of generation of either set of waves, the other set being unaffected.



NO. 607,177.

607,247. Electric Motor. Warren S. Johnson and Henry Winkenwerder, Milwaukee, Wis. Application filed November 9, 1896. Renewed June 4, 1898.

Claim is made for the combination of an electromagnet and armature, one of which is capable of oscillation transversely to the lines of magnetic force passing through it, a ratchet wheel having a rim of elastic, non-sonorous material, and a pawl carried by the oscillatory part and adapted to engage with the rim and turn the wheel.

607,250. Electric Cutout. Harry A. Lewis, Norristown, Pa. Application filed July 14, 1897.

An electric cutout is provided with a tube, a non-conducting rod held removably in the tube, a wire coiled on the rod, caps held in the ends of the rod, spring-contact plates engaging the caps, and a circuit breaker operated by the expansion of the tube.

607,251. Fuse Holder, Circuit Breaker and Lightning Arrester. Harry A. Lewis, Norristown, Pa. Application filed July 14, 1897.

The device is provided with a circuit breaker comprising a spring-pressed lever connected with one end of the line wire and arranged for connection by a fuse with the other end of the line wire, a fixed carbon connected with the line wire, a movable carbon carried by the lever, and stationary insulating material separating the carbons in their normal position.

607,302. Electric Locomotion. Henry Van Hoevenbergh, New York, N. Y. Application filed November 20, 1896.

A current collector or trolley is provided with means for supporting it on one conductor of a supply system, an elastically yielding arm adapted to make contact with a companion conductor, and a guide rail on the trolley frame to force aside the arm of a trolley on the companion conductor, thereby permitting the trolleys to pass one another.

607,311. Electric-current Controller. Ernest E. Werner, Philadelphia, Pa. Application filed February 23, 1897.

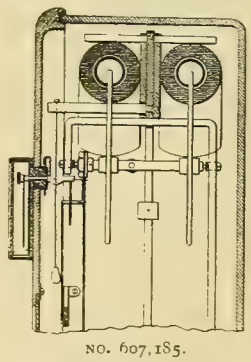
Claim is made for the combination of a frame, a rotatable carrier journaled in the frame, a hand shaft in frictional contact with the carrier, a segment of resistance material on the carrier, a brush in contact with the resistance material, a hand or pointer adapted to turn with the carrier and a dial fixed in relation to the carrier and its hand.

607,315. Insulator. Charles L. Wingard, Walla Walla, Wash. Application filed April 13, 1898.

An insulator is constructed of two duplicate sections matching to form a tubular body, each section having its edges provided with interlocking shoulders, and each section also having a head provided with a notch leading to the bore thereof, through which notch the conductor may be passed, whereby the insulator may be placed on the conductor after the conductor is in place.

607,343. Switchboard and Alarm Mechanism. John P. Conway, New York, N. Y. Application filed May 5, 1897.

In an electric alarm mechanism, the combination with the day and night circuits, the main line being connected with the central-office indicator and signaling devices, magnets adjustably secured to the switchboard and in the main circuit having an armature lever adapted to engage with the signaling devices, the signaling devices being provided with independent circuits, and means for closing either the day or night circuits.



NO. 607,185.

607,351. Electric Railway. William W. Doty, New York, James A. MacKnight, Mount Vernon, and Charles Grauten, New York, N. Y. Application filed January 25, 1897. Renewed December 24, 1897.

An electric railroad is provided with a working conductor made in sections insulated one from the other, a solenoid for each conductor section and having its coil of wire connected with the conductor section and with the ground, the magnetic plunger of the solenoid being provided with alternately arranged sections of conducting and non-conducting materials, sets of contact plates engaging the plunger sections, one set of the contact plates being in the ground wire for the preceding solenoid and the other set being in the wire for connecting the conductor section with a feed wire.

607,387. Trolley for Electric Railways. Henry Van Hoevenbergh, New York, N. Y. Application filed August 31, 1897.

A trolley is provided with a plurality of wheels set at an angle to bear upon a supply conductor at their peripheries, the wheels being mounted in a frame provided with projections lying close to their sides to prevent spreading.

607,407. Alarm System. Clyde Coleman, Chicago, Ill. Application filed October 18, 1897.

The circuit protecting a vault or other inclosure and extending through separable door contacts is combined with means for varying the nature of the circuit within the vault at intervals, and a device is provided responsive to a momentary separation of the door contacts to permanently change the nature of the circuit.

REISSUE.

11,678. Electric Signaling Mechanism. Lewis G. Rowand, Camden, N. Y. Application filed December 15, 1897. Original No. 593,692, dated November 16, 1897.

The first claim is given: In combination, a main circuit, signaling devices on said circuit, a second circuit, receiving devices on said circuit, an electric device on said main circuit, a switch device consisting of two members, controlling said second circuit, the first member of which is moved in one direction by said electric device when energized, and means to return said member to its initial position when said electric device is de-energized, and a device adapted to hold said second switch member out of electric connection with said first switch member in its movement under the action of the electric device.

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United States Government at the Trans-Mississippi and International Exposition.

By far the most interesting collection of exhibits at the Trans-Mississippi and International Exposition is that contained in the United States government building and intended to illustrate the organization, operation and application of the several executive, judicial and legislative departments, as well as as to present a concise and comprehensive history of the growth of the nation and its industrial development. There are several departments that appeal directly to electrical men, but there is none other that has the peculiar fascination exercised by the army and navy at this time. Of course there are many applications of electricity illustrated in these, but the most important is that relating to coast defenses.

Electrically Operated Submarine Mines.

Ever since the destruction of the American battleship in Havana harbor on the night of February 15th, public interest has been manifested in everything pertaining to the construction, location and operation of those terrible engines of war whose effectiveness was so thoroughly demonstrated on that occasion. Americans learned a valuable lesson from the fate of the Maine. The submarine mine was immediately adopted for the protection of rivers and harbors along the sea coast, and it is safe to say that never before were so many mine-fields established in such a remarkably short time as in the period immediately following the declaration of war against Spain. These mines were all electrically operated, but three distinct patterns of construction were employed. One of each type was selected for the government exhibit at Omaha. The picture on this page, Fig. 1, is an excellent view of the torpedo and submarine mine collection which comprises one of the greatest attractions at the exposition.

The most conspicuous feature of this group is the mine in the foreground, and this, it may be remarked, attracts the greatest attention on the part of visitors, as it is said to be similar in design and construction to the mine which was employed in the destruction of the Maine. It is a 28-inch ground mine, designed to rest on the bed of the river or bay which it is intended to guard. When in service it is connected to a buoy, floating near the surface of the stream, which makes contact with vessels passing over the mine. It is a heavy cast-iron hemispherical case containing a compartment for 250 pounds of dynamite. In the hollow sphere which comprises the buoy floating near the surface is the electrical mechanism, the principal feature of which is a circuit-closer by which signals are transmitted and the mine exploded. Wires lead to the mine and to the shore, so that when a ship strikes the buoy a signal is transmitted to the shore and the operator is notified of the presence of a vessel over the mine. The current employed is so weak that it will not fire the mine, and if the operator desires to destroy the vessel he sends back from the shore a current sufficiently strong to set off the fuse in the mine.

Next to the ground mine in the picture is shown a spherical torpedo, to which an anchor it attached when in service to hold it at a certain point. Another type shown is a large buoyant torpedo which is also kept in place by an anchor. In both of these torpedos the electrical firing mechanism as well as the charge of high explosive material is contained in the metallic case which is floated near the surface of the water.

FIG. 1. UNITED STATES GOVERNMENT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION — ELECTRICALLY OPERATED SUBMARINE MINES.

Junction boxes for making the electrical connections in the arrangement of a bed of mines are also shown. They will be noticed lying on the floor in the picture. They are of the standard type adopted by the government for this class of work. They were especially designed for this service, being practically water-tight and affording ample protection for the contacts required. The use of submarine mines and torpedoes in conjunction with coast fortifications has given the engineers and ordnance officers almost as many difficult problems to solve as were presented when modern ordnance and disappearing gun carriages were first developed. Submarine mines are as much a part of the fortification scheme at all the great coast cities as the installation of guns and mortar batteries. The object of the mines and floating torpedoes is to destroy any vessel that might succeed in passing the forts. Submarine mines are particularly efficient, of course, in narrow entrances to harbors, and in channels such as heavy draught vessels must take in reaching port. They may be classified as observation mines, which are fired from shore when a ship is judged to be within range; automatic mines, which are self-firing on being struck by a ship and electrical-contact mines, which, on being struck by a ship, give notice to the operator, who, by throwing a switch, fires the mine.

It has been demonstrated that the automatic mine is not as efficient and reliable as the electrically operated mine, and that in case of an accident which might release it this type would be exceedingly dangerous to friendly vessels as well as to the enemy's fleet. This fact will be appreciated when it is explained that mines of this class consist of an iron case containing the explosives and a cable attached to an anchor by which they are held in place, that this case has a number of projecting points, on the end of which are firing pins, and when a ship hits one of these pins the latter is driven in, exploding a percussion cap and thus bursting the charge. Another type which was formerly used very generally is the observation mine, which may be fired by one or two observers. If only one observer is employed, mines are laid down in rows, the lines of which converge to the observation station, and all the mines in one row are connected so that they can be simultaneously fired when the ship is passing the range line. When the mines are connected by two observers, they are laid according to a system of cross observation, by which it is possible to fire any particular mine when the ship is above or in close proximity to it. The objection to this class of mines will be readily understood. They are of little practical value at night or in foggy weather, and even under the most favorable conditions their effectiveness is largely a matter of conjecture. When Admiral Dewey entered Manila bay, mines were exploded all around his vessels, but none happened to be directly under them. When Hobson sunk the Merrimac in the channel leading into Santiago harbor, several mines were blown up in the vicinity of the collier, but none of them was near enough to damage her. In both cases observation mines were employed and in neither were they effective.

Experience has shown that the type which is unquestionably the most certain in its action is the electrically controlled mine, three forms of which are shown in the cut (Fig. 1). In these the charge is exploded either directly when the mine is struck by a ship, or at the will of the operator on shore, on receiving a signal automatically transmitted from the mine at the moment of contact. This type may be

either the buoyant or ground mine, according to the depth of the water in any particular location. Where the water is not too deep to interfere with the destructive force of the explosive, the mine is placed on the bottom, and is known as a ground mine; in deeper water it is placed in a buoyant cylinder or sphere, which is secured by an anchor, and floated at the desired depth below the surface. In anchoring mines, care must be taken that they are not too near the surface when the tide is low. An immersion of at least 10 feet is considered necessary to give the charge sufficient force to destroy a heavy ship On the other hand it has been shown that a strong current reduces considerably the efficiency of the buoyant torpedo, since it may be forced down so far by the swift-running stream as to render it useless. In such cases ground mines are placed on the bottom. Authorities differ as to the relative efficiency of the ground mine and buoyant torpedo. By some it is contended that the buoyant torpedo has an advantage over the other type, in the fact that it lies nearer the object of attack, and, therefore, does not require to be filled with such a heavy charge of explosive, while on the other hand it is claimed that the force of the explosion is divided, part being directed downward, while in the ground mine the resistance of the bed of the river causes the entire force to be directed upward. It is generally admitted that all of these mines can be most effectively used where the water is not very deep and the current not very strong, the rule being the greater the depth the greater must be the amount of the explosive used. Ground mines have been used in water 65 feet deep, and for this depth a charge of gun-cotton equivalent to 4,800 pounds of powder was required.

A submarine mine consists of a metal case and should provide for a charge of a high explosive such as dynamite, gun-cotton or blasting gelatine, and an electric fuse that may be fired either automatically or at the will of the observer on shore. The pressure necessary to blow a hole through a formidable war vessel has been estimated to range from 8,000 to 12,000 pounds per square inch. In case of failure to blow a hole sufficiently large to cause the ship to founder, it is thought that ordinarily the shock would be so great as to throw all the delicate machinery out of action, leaving the vessel a ready target for the guns on shore. There is still another danger to a ship from the submarine mine, and that is the possibility of setting off the high explosives on the vessel by the submarine shock. It may be mentioned here that the weakest point in the system of submarine mines is the fact that they may be rendered useless by counter-mining. Large charges of dynamite set off in mine fields would explode every mine within sympathetic radius. Of course the mine fields should be protected by rapid-fire guns which would be able to repulse small boats sent ahead of cruisers and battleships for the purpose of counter-mining.

The method of arranging submarine mines in harbors and the details of the electrical and mechanical connections of the several groups, with the firing station on shore, were explained in the Western Electrician of April 23d.

Electrically Operated Mint Press.

In the space occupied by the Treasury Department a stamping machine has been set up for operation, in order to show one step in the process of making coin. This press was received from the United States Mint at San Francisco, where it has done service before being shipped to Omaha for exhibition purposes. It is operated daily during the exposition, but of course is not employed in stamping coin. Its work at present consists of stamping souvenirs, for which there is a lively demand. The souvenirs are somewhat larger than a half-dollar, but not as large as a dollar. The press is driven by a small electric motor made by the Holtzer-Cabot company, which is shown in the picture, Fig. 2. It is belted to a shaft below the floor, which in turn drives a countershaft, from which power is taken by the press. Current is supplied from the service mains of the exposition plant. It will be seen at a glance that this temporary arrangement was hurriedly installed, as were also many other exhibits in which power is used, as it was not determined until shortly before the exposition opened to operate machinery in the exhibition buildings. Of course it was out of the question to use steam in any of the principal buildings, and provision was hastily made for electric motor service, accordingly.

Survey for the Pacific Cable.

An excellent model of the Albatross is on exhibition in the space allotted the United States Commission of Fish and Fisheries. This vessel has an interesting record, as it was employed in making the first survey of the Pacific Ocean for the proposed submarine cable between the Hawaiian Islands and California. In view of the recent action of the United States government in annexing the Hawaiian Islands and the pressing demand for the establishment of telegraphic communication between Washington and Honolulu, any information upon the subject is of course timely.

The Albatross, which is illustrated in Fig. 3, is an iron twin-screw steamer, rigged as a brigantine, and constructed and equipped for deep-sea exploration. The necessity for a vessel of this type became apparent in 1880, when the Fish Hawk returned from her initial trip offshore to the region now known as the Gulf Stream slope, and plans were prepared in accordance with the requirements of the service to be performed. The vessel was built by the Pusey & Jones company of Wilmington, for $145,800, the special equipment raising the cost of the boat and outfit to $200,000. She was launched in 1882, and was placed in commission November 11th of that year. The boat has been in actual service constantly ever since, and her records furnish a vast fund of information upon scientific subjects. In navigation equipment and scientific apparatus for the special work upon which she was to be engaged, the Albatross surpassed any vessel afloat at the time she was launched. She was the first United States government vessel to utilize electricity for illumination and power purposes, and probably the first government vessel in the world to possess a ship-lighting plant. The equipment comprised an Edison dynamo driven by an Armington & Sims engine, 152 incandescent lamps, several portable lamps of eight candle power each and a projector used at the table sieve to facilitate the work of the naturalists. A feature of the lighting equipment was the submarine electric lamps improvised on board the Albatross by connecting an ordinary 16 or 50 candle power lamp to one end of an insulated cable, carefully wrapping the joint to make it water-tight, while a plug on the either end formed a convenient connection wherever a lamp socket was to be found. The lamps were especially useful in collecting and assorting specimens after dark at or near the surface, lighting up the sounding machine, dredging gear or any part of the deck remote from fixed lamps. The Albatross was supplied with the most complete outfit of sounding instruments possessed by any vessel in the world.

In 1891 she was commissioned to make the survey for the proposed Pacific cable. The work was authorized by an act of Congress passed on March 2, 1891, providing for a deep-sea survey to determine the practicability of laying a telegraph cable between California and the Hawaiian Islands. The Albatross was engaged in this work from October, 1891, to January, 1892, and in that time two lines had been run between Monterey Bay, California, and Honolulu, Hawaiian Islands. The Albatross was detached from the work for other service in February, 1892, and the latter part of the survey of the lane along the bottom of the Pacific Ocean between California and the Hawaiian Islands was carried out by the United States steamer Thetis, by running a line of soundings and deep-sea observations between Point Concepcion, California, and Hilo Bay, Hawaii. The Thetis is a wood-built vessel of 1,250 tons displacement, propelled, through a single screw, by one inverted, vertical, direct-acting, compound engine. She is rigged as a barque, and carries sail to royals. Her equipment for the work in connection with the cable survey was the same as that of the Albatross. The survey was prosecuted with all the care and accuracy that the means for modern deep-sea research afford, and, as a result, maps and observations were prepared furnishing knowledge of the route and establishing the fact that the laying of a cable on almost any line between California and the Hawaiian Islands was practicable. A lane about 300 miles wide was developed between California and Hawaii, and the results, as shown by the report of Lieutenant-Commander Richardson Clover, the hydrographer of the United States navy, seem to indicate that the most favorable route would be a rhumb line between Monterey Bay, California, and Honolulu.

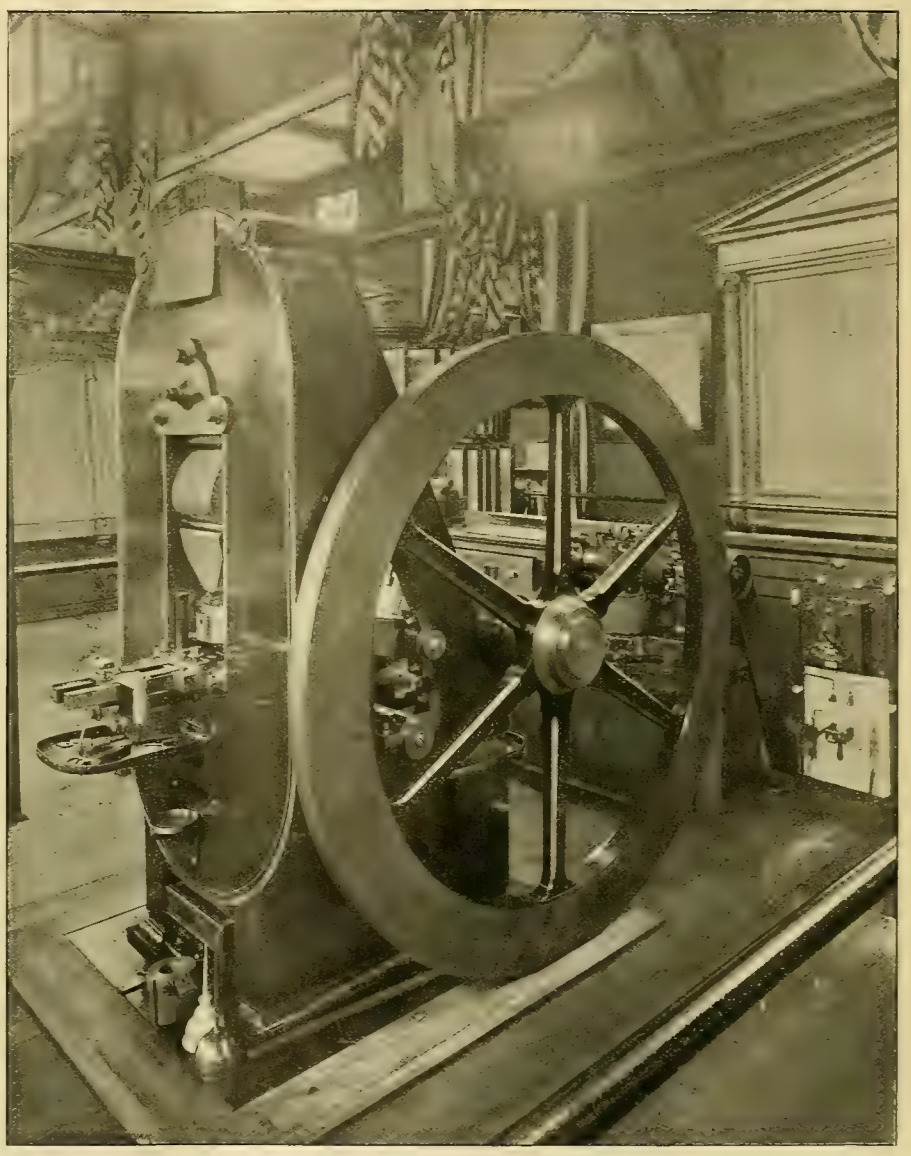

FIG 2. UNITED STATES GOVERNMENT AT THE TRANS MISISSIPPI AND INTERNATIONAL EXPOSITION.—ELECTRICALLY OPERATED MINT PRESS.

Some idea of the character and extent of the work involved may be gained from the plan of the survey, which consisted in developing the bottom of the ocean along a lane between California and the Hawaiian Islands by observations of the depth, the character of the bottom soil, the temperature at the surface and the bottom of the ocean, and the vertical distribution of temperature throughout the whole depth; in sounding the depths and developing the characteristics of the bottom of parts of the approaches to the coasts favorable for the landing of submarine cables at Salinas Landing and Point Concepcion, California, and at Hanauma Bay, Mauna Loa Bay, Kapua Entrance, Waikiki, Honolulu, and Hilo Bay, Hawaiian Islands. Records of all of this work were carefully preserved. Soundings were taken at alternate intervals of 10 and two miles along great circles of the earth between Salinas

Landing and Honolulu and between Point Concepcion and Hilo Bay, and along a rhumb line between Salinas Landing and Honolulu. At each sounding specimens of the bottom soil were obtained, and the temperatures of the air and of the surface and the bottom of the ocean were observed. At four or five equidistant stations upon each line of soundings series of temperatures were observed, consisting of observations at the surface, at depths of 25 to 1,000 fathoms, and at the bottom. The density of the sea water was also observed at numerous stations. Wherever, by reason of a notable change in the depth or in the bottom soil or temperature, there was reason to suspect any important irregularity in the bed of the ocean, numerous soundings were taken to provide for an examination of the locality in detail.

The geographic latitudes and longitudes of the stations where observations were taken were deduced, at average intervals of 100 miles, by observations of heavenly bodies for Sumner's lines of position by means of the sextant and sea horizon, and time carried by chronometers from the established meridians at the ends of the route; and between the positions thus established, by the course steered and the distance run as determined by the compass and the log.

In this work the total length of lines sounded by the Albatross was 4,511 miles, and by the Thetis 2,274. The total distance steamed by the Albatross in making the cable surveys was 8,735 miles. During these expeditions both vessels made 874 soundings, and secured 720 bottom specimens considered worthy of preservation. Important statistical information is presented in the official recapitulation of the work performed. It was determined that the length of the great circle line from Salinas Landing to Mauna Loa Bay was 2,091 miles; length of great circle line from Salinas Landing to Waikiki Bay, 2,098 miles; length of great circle line from Point Concepcion to Hilo, 2,034 miles; length of rhumb line from Salinas Landing to Mauna Loa Bay, 2,107 miles; length of rhumb line from Salinas Landing to Waikiki Bay, 2,114 miles.

As a result of these investigations the route along the rhumb line between Monterey Bay and Honolulu has been determined upon as the most practicable, since it is the one that will require a minimum length of cable in passing over an even bottom consisting of soil which is favorable for its protection and preservation, avoiding submarine mountains and volcanic regions where substances exercising an injurious chemical action on the covering of the cable are likely to exist and where future convulsions may cause destruction. In the official report mention is made of the considerations which have governed the determination of the route that is recommended, and the causes of damage to submarine telegraph cables. It is explained that the principal deposits found at the bottom of the ocean may be classified as shore deposits, globigerina, pteropod, diatom and radiolarian ooze, and red, gray and chocolate-colored clays. The reports says that of all bottoms those consisting of the oozes are the best adapted for prolonging the existence of the cable in an unimpaired state, because they appear to be most nearly free from the substances that have a devastating influence on the sheathing of the cable, which quickly becomes embedded in them, and, moreover, because the existence of such a bottom precludes the supposition that there can be strong submarine currents to exert a wearing action upon the cable where it happens to be suspended in festoons between neighboring elevations of the ocean bed. It cannot be stated what action, if any, goes on between the iron of a cable and the substances which enter into the composition of deep-sea deposits, but experience has proved that some agent very destructive to the sheathing wires frequently occurs in isolated patches. It is suggested, however, that in many places in the bed of the ocean, outcrops of veins of minerals occur as they do on land. Where indications of such a condition have appeared, the localities have, as far as possible, been avoided in selecting the route for the Pacific cable. Shore deposits are viewed as the most dangerous to a cable, as they contain decaying animal and vegetable matter. The iodine contained in seaweed has been known to destroy iron rapidly. Accordingly localities which afford approaches to the coast in deep water over bottoms of mud or sand, and which have only a narrow area between the shore and 100-fathom line, have been selected as landing places for the cable at the ends of the route, with a view of exposing a minimum length of cable to the action of shore deposits and to the damaging effects of vessels' anchors, as well as to reduce the wear resulting from the action of waves and breakers. In the shallow waters of the Hawaiian Islands the temperature was found to be about 77 degrees F. in the winter, and as a gutta-percha core may sustain deformations sufficient to bring about a weakening of the insulation on this account, the advisability of employing caoutchouc as the insulating material at that end of the line is suggested.

Damage has resulted to submarine cables through the ravages of marine animals. In 1859 a hempen-covered cable, upon being raised after scarcely a year's submergence, was found to be covered with millions of little animals. The hemp had disappeared, and the gutta-percha had been pierced by small round holes. Similar damages have since been found to have been sustained by cables in nearly every part of the world. Although some defects have been discovered in deeply submerged cables which can be charged to these animals, it is generally believed that those which pierce to the conductor do not live at great depths. As early as 1852 it was proposed to cover cables with strands of hemp and a very thin metallic ribbon to protect the gutta-percha, and a bituminous composition was also applied to the exterior armor with the same end in view. A combination of these systems has been used for some years upon cables that have been submerged in depths less than 100 fathoms in regions infested with these animals.

It would be impossible to present here all the valuable information gathered by the Albatross and Thetis for the government in prosecuting the survey for the Pacific cable, but there is no doubt that it will all be utilized when the work of establishing telegraphic communication between San Francisco and Honolulu is begun.

FIG. 3. UNITED STATES GOVERNMENT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—THE ALBATROSS (SURVEY FOR THE PACIFIC CABLE).

Aluminum Conductors at Niagara.

By Orrin E. Dunlap.

Not the least interesting feature of the new installation in the station of the Niagara Falls Hydraulic Power and Manufacturing company is the aluminum bars and cables used for the purpose of conducting the current from the new generator to the plant of the National Electrolytic company on the high bank. The generator in question was illustrated and described in the Western Electrician of June 25th. It is the largest of its kind yet constructed. The conductors are the first of the kind placed in service, and for this reason considerable interest is attached to them. The aluminum bars used are 25 feet long, six inches wide and half an inch thick. Four are placed in parallel. Every 25 feet the bars are bolted and riveted together, and extend from the power house to the top of the cliff along the side of the huge penstock which stands out from the bank like a column, as shown in the accompanying cut. The bars are supported on brackets, seven of which are attached to the penstock's side. On reaching the top of the cliff the bars are connected to aluminum cables, 12 of which are used on each leg. These aluminum cables are about 1 1/4 inches in diameter, made of wire about the size of No. 10, the cable being covered with rubber insulation. In connecting the ends of the bars to the cables, castings which contain sockets are used. The ends of the cables are placed in the sockets, and then melted tin is poured about them, the joint that is thus formed being permanent and solid. In this installation about 22,000 pounds of aluminum are used, and it is estimated that the same work would call for 48,000 pounds of copper. If the same style of erection was employed, this would have placed more than double the weight in conductors on the penstock. The task of erecting conductors to run up the Niagara cliff is by no means an easy one, but Wallace C. Johnson, the chief engineer of the Niagara Falls Hydraulic Power and Manufacturing company, and Frank G. Lott, the electrical superintendent, were highly pleased with the comparative ease with which the aluminum conductors were placed in position, and since they have been in use they are delighted with the service rendered.

ALUMINUM CONDUCTORS AT NIAGARA.

The conductivity of aluminum compared with copper of the same section is 63 to 64 per cent., and for the same weight more than double.

At Niagara there is quite a strong belief that there is a growing field for aluminum as feeder cables. It will be recalled that the conductors here referred to are the second installed by the Niagara Falls Hydraulic Power and Manufacturing company in connection with the power house in the gorge. The first set of aluminum conductors are used to carry current to the lower works of the Pittsburg Reduction company, located on the high bank 200 feet above the power house. These first cables are two in number, each of 250 strands, and are placed inside of a tower, through which they run up the cliff. The style and shape of the new aluminum conductors seem to be the most acceptable.

Storage Battery for Chicago Elevated Railway.

The Electric Storage Battery company has just closed a contract with the South Side Elevated Railroad company of Chicago for two electric storage batteries of about 700 horse power each, one to be installed in a sub-station on the company's

property at Twelfth street, and the other in a sub-station on the property at Sixty-first street. Each battery will be provided with tanks and bus-bars of suitable size for doubling the capacity of the battery. The batteries will be placed in parallel with the line, and so arranged as to take care of the maximum fluctuations, relieving the power house of a portion of its load, and at the same time keeping up the potential at the extreme points on the line. This will be the largest installation that has yet been made for feeder regulation, so that, when completed, Chicago will have the largest central-lighting station battery and the largest feeder-regulation battery yet installed. Frank H. Clark, Chicago manager for the Electric Storage Battery company, closed the contract last week.

Buffalo Transformer Station.

By Orrin E. Dunlap.

The Cataract Power and Conduit company of Buffalo has placed the first section of the permanent installation of the Ohio street transformer station in operation. While current has been supplied from this station for some time, the installation was of a temporary nature, the transformers used being similar to those employed in the transformer house of the Niagara Falls Power company at Niagara Falls. The permanent installation was made by the Westinghouse Electric and Manufacturing company, and placed under the supervision of W. K. Dunlap, the local engineer of the company. The Ohio street transformer station is located in the center of the elevator district of the city of Buffalo,

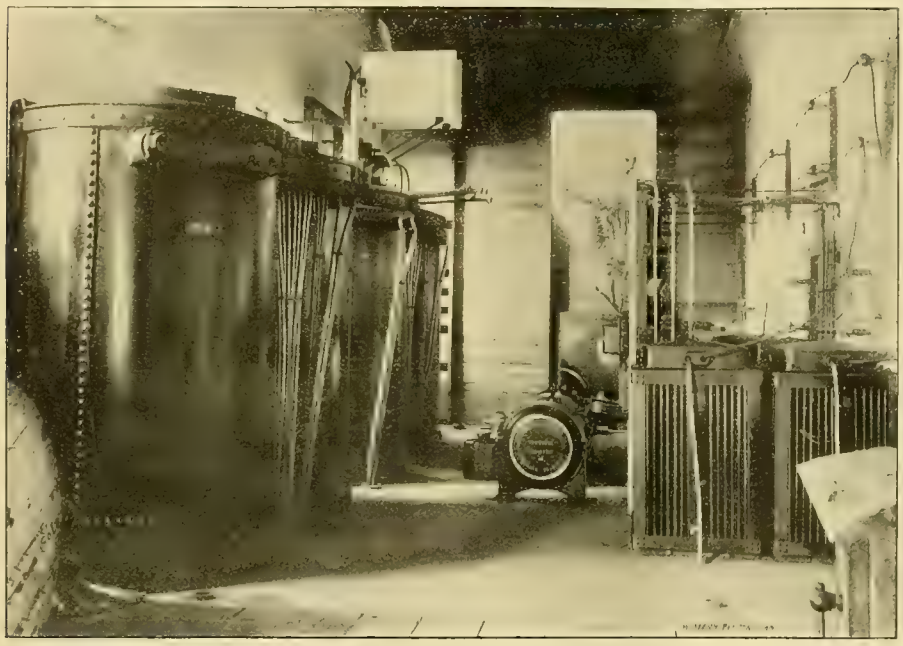

FIG. 1 BUFFALO TRANSFORMER STATION.—GENERAL VIEW.

and from this station current is now supplied to the Great Northern elevator, the Electric elevator and the Union Dry Dock company, with many prospective customers. The building is of brick, the space occupied being 90 by 18 feet. The plans of the Cataract Power and Conduit company contemplate the placing of three such outfits as are here illustrated and described, and when all are in place the capacity of the plant will be about 10,000 horse power.

By referring to the general view of the station, Fig. 1, it will be seen that the main transformers and the high-tension board, which is to be seen at the end over the large transformers, have been placed on one side of the room, and the low-tension board and low-series transformers on the other side. The wiring seen to the right is temporary. Changes in the arrangement will be made on the removal of the temporary installation, when the high-tension board will occupy the end of the room. Four large transformers (Fig. 3) have been placed, three for actual service, the fourth as a reserve. Each of these large transformers has a capacity of 850 kilowatts, making the capacity of the three in use 2,550 kilowatts, which is said to be the largest output yet obtained from a single group of transformers. The outer covering of the large transformers, which contains the oil, is of boiler iron, the base plate being of cast-iron. A cast-iron cover, in which are two manholes, makes it possible to examine the terminals. The large transformers are cooled by water. On the primaries the star connection is used, and on the secondaries the delta connection. The voltage at which the Niagara power comes to the station is 11,000, and the service of the installation is to reduce it to 2,200, which is the potential at which the current is distributed to plants using it. The diameter of the cases of the large transformers is a little over five feet, while the height is about nine feet. The weight of one of the transformers is nearly 20,000 pounds.

The winding of the transformers is made of deep, thin coils, magnetic leakage being reduced by the primary and secondary being interleaved. Heavy end-frames hold the short iron together. Outside the iron the coils are spread apart, thus increasing the cooling surface exposed to the oil without loss of space. Spacing strips about the coils serve to increase the surface of iron exposed to the oil. When the transformers were made each coil was insulated and treated separately, after which they were placed in position with sheets of solid insulating material between them. Running down about half the depth of the case of each transformer are three coils of iron pipe, and through this pipe the water for cooling is circulated. Each of the coils, which are connected in multiple, is fitted with a valve in order that the flow through the respective coils may be adjusted as desired. After this adjustment has been properly made the transformer will do its work with but little further attention.

The static transformers are six in number, each of 75 kilowatts capacity. They stand in the rear of the low-tension switchboard, while in front of the board have been placed three regulators, one for each three-phase circuit. These transformers are designed to regulate the secondary voltage, and have the same principle as the larger transformers. They are of different shape, however, as will be seen by Fig. 2, and the method of cooling is different.

On the interior of the regulators shown in front of the low-tension switchboard (Fig. 2) are two dials. Movement of the handle seen at the top of the regulator in one direction operates the dial in one phase, and in the other direction in the other phase, thus alternately changing the voltage in the two phases. The wheels seen to the left of the regulator operate the switch for reversing the primaries of the series transformers, a lamp indicating when the contact arms are in position.

The high-tension switchboard is provided with three circuit breakers, each having a break of 48 to 50 inches. They have long wooden arms, the contact being made with a copper terminal and also a carbon terminal. The break comes first on the copper and then on the carbon. The contact surface is not damaged, all the burning being in the carbon. The lower part of the high-tension board is provided with a plug system, by which the different high-tension circuits can be thrown into the converters.

The low-tension switchboard is fitted with a new type of alternating-current circuit breaker and the ordinary type of switch. This board has three panels, each controlling one three-phase feeder. The board is equipped with circuit breakers, switches, alternating-current ammeters, alternating-current voltmeters, and integrating voltmeters. The current enters the basement over lead-covered cables. The wire used in connection with the high-tension board is No. 000 and for the low tension it is No. 0000.

Electric-railway Litigation.

Another decision in injunction proceedings for infringment of street-railway motor patents is being circulated by the General Electric Company. This time the Sprague Electric Railway and Motor company obtained an injunction against the Steel Motor company in the Circuit Court of the United States for the Western District of Pennsylvania. The opinion was filed on July 12th by Judge Buffington. The court follows the decision of the second circuit, which adjudged the patent (No. 324,892) issued August 25, 1885, to Frank J. Sprague valid, and entered a decree accordingly.

Two-wire Distributing Systems and Lamps, 200-240 Volts.[1]

By John W. Howell.

Distributing systems operating at 200-240 volts with simple two-wire circuits first attracted attention about four or five years ago. These early plants used two 110-120-volt lamps in series and were instaled as a means of competing in cost of installation with three-wire plants without resorting to the alternating-current system, with its disadvantages where motors are operated.

The growth of these plants was slow until the demand created by them led to the production of the 200-240-volt lamp and practical experience had shown the weaknesses of these lamps and led the makers to overcome the difficulties met in their manufacture. What these weaknesses were can be judged by the following extracts from previously published articles:

"The consensus of opinion at the present day of the average types of high-voltage lamps undoubtedly points to the fact that a large percentage is expected to short-circuit as soon as they are put up, and I have heard several engineers say that they expect about one in 12 to go in this way.

"There is no doubt whatever that almost all the present day 200-volt lamps are only suitable for burning in a vertical position. As soon as any other position is adopted defects become prominent. The long, thin fiament soon drops onto the bulb and cracks it. Also electrostatic attractions, owing to higher voltage, cannot be resisted by the long, thin filament, and this is an additional cause of the filament approaching the bulb.

"The effect of electrostatic attractions on long, thin filaments is even noticeable with lamps burning in a vertical position."

These are extracts from a paper read by Mr. G. Bingswanger Byng before the British Institution of Electrical Engineers on February 24, 1898.

These defects have been entirely remedied, and the experience of many plants operating 200-240-volt lamps during the last year proves these lamps to be just as reliable in service as are 110-volt lamps. The development of the lamp has taken considerable time, and the growth of the 200-240-volt two-wire system, in spite of the shortcoming of the early lamp, is due to compensating advantages in other elements of the system.

These advantages over the three-wire system are (1) cheapness of installation and (2) simplicity of operation.

1. Cheapness of installation of the 200-240-volt two-wire system, when compared with the 110-120-volt three-wire system, arises from the use of a single large dynamo where the three-wire system requires two, each having half the capacity, with the accompanying duplication of regulating apparatus, indicators, ammeters, etc. There is also a saving of the entire cost of the neutral conductor of the three-wire system, which conductor in street mains (as distinguished from feeders) and in house wiring should be as large as the outside wires.

Three-wire plants in cities whose business warrants the employment of the skill necesary to operate the system to best advantage successfully use 110-120-volt 3.1 watts per candle lamps, and get very excellent results from them. The 200-240-volt two-wire system cannot be considered a competitor of the three-wire system under these conditions since the best 220-240-volt lamp on the market to-day is a four watts per candle lamp. But it is my opinion that in smaller installations, whose conditions call for a 3.5 watts per candle lamp when a 110-120-volt three-wire system is used, the advantages of the two-wire 200-240-volts system are sufficient to offset the disadvantages of a four as compared with a 3.4 watts per candle lamp. Under normal conditions the performance of the present four watts per candle 200-240-volt lamp as regards life and maintenance of candle power is about 25 per cent. poorer than the present 3.5 watts per candle 110-120-volt lamp, but it is my opinion that the greater irregularity in pressure ordinarily found in the three-wire plants we are now considering, as compared with the two-wire plants operated under similar conditions, fully counteracts, by its injurious effects upon the lamps, the advantage in life and candle power which the 110-120-volt 3.5 watts per candle lamp has under normal conditions over the 200-240-volt four watts per candle lamp.

In considering the relative advantages of the two systems, in the case of moderate size plants above referred to, we must charge against the saving effected in a two-wire plant, by its single equipment and omission of the neutral conductor, the increased capacity of machinery and conductors made necessary by a four watts per candle as compared with a 3.5 watts per candle lamp.

Considering the copper required by a 220-volt two-wire system using four watts per candle lamps as our unit, the copper required by the two outside conductors of a 110-volt three-wire system using 3.5 watts per candle lamps will be .875. The amount to be added to this for the neutral conductor will vary somewhat with location of the station with reference to the points of consumption. If we assume that one-half the copper is installed for feeders and one-half for the distributing mains, and that the neutral wire is one-third the size of the outside wire in feeders and the same size in mains, then the total

1. Read at the fifteenth general meeting of the American Institute of Electrical Engineers, Omaha, June 27, 1898.

copper in the neutral conductors of feeders and mains will be 29 per cent. of the amount used in the two-wire 220-volt system, and the total copper used in the 110-volt three-wire system will be 16 per cent. greater than the copper used in the 220-volt two-wire system. This comparison of the costs of copper does not consider the cost of wiring customers' premises, which is usually borne by the customer; it is, however, an advantage to the 220-volt system that this wiring will require at least 20 per cent. more copper for the three-wire 110-volt system than for the 220-volt two-wire system.

The four watts per candle, as compared with the 3.5 watts per candle lamp, would require for the 200-240-volt two-wire system one-seventh greater capacity of boilers, engines and dynamos than would be required for the three-wire 110-120-volt system.

The duplication of apparatus required for the three-wire system will only partly offset this increased cost in the two-wire 200-240 volt system but the cost of this duplication of apparatus, together with the increased cost of copper required, will, in many cases, make the cost of installation of the three-wire system at least equal to that of the 200-240-volt two-wire system, leaving the simplicity of operation of the two-wire system to be balanced against the increased cost of fuel required to operate four watts per candle, as compared with 3.5 watts per candle lamps.

During the time the plant is operated considerably below its rated capacity, which will probably cover even the maximum load during the first year of the plant's existence, and all but three or four hours per day at all times, I think the increased fuel consumption due to four watts per candle lamps will not be appreciable because of the poor efficiency of boilers and engines with light loads, and the total increased consumption of coal during the year will, I believe, be a small consideration under most circumstances, and, in my opinion, not enough to balance the simplicity of operation above noted.

A few months ago I made a trip through some of our central states, visiitng a number of 200-240-volt plants to get a knowledge of the practical workings of the systems from the persons actually operating them, hoping to get from their experience information concerning existing conditions which would be of value in the lamp factory.

Naturally my first questions to the man who operated the plant concerned the lamps. Were they generally satisfactory? Were they long-lived? Did they ever explode? I was greatly pleased with the answers I received. The lamps were reported to be almost universally satisfactory. They were very long-lived, in fact, too long-lived, for better service would be rendered if the lamps were renewed when they began to get dull, and not allowed to remain in service after they ceased to give a first-class light.

These four watts per candle 200-240-volt lamps

FIG. 2. BUFFALO TRANSFORMER STATION.—LOW TENSION BOARD.

may be used for 600 hours and still give a good light, but I think this is about the limit of their useful life. If not taken in they will keep on burning for a long time and will give an average life of over double that figure before breaking.

The reports concerning exploding were equally satisfactory. For the past year or more, exploding lamps had been practically unknown; previous to that time, however, this had been one of the most serious objections to the system.

All these plants have been installed with switches, cut-outs and other appliances made for 110-120-volt installations, and it is remarkable how little trouble has been caused by them.

Ordinary key sockets have been freely used, and experience has shown the Edison screw socket and lamp base to be preferable to other types. Some engineers recommend keyless sockets and good snap switches, to avoid possible failure of the key socket to break the circuit. In order to get the desired factor of safety, the General Electric company has recently developed a special key socket for this work, having a break-gap twice as great as the sockets designed for 110-120-volt systems, and having a fiber-insulating lining between the outside shell of the socket and the screw shell which is connected with the circuit. This fiber lining projects sufficiently beyond the screw shell to prevent contact with the circuit when the lamp is in the socket. The lamps are provided with short bases designed to be completely covered by this fiber lining, so it is impossible to get a shock by touching the lamp when it is burning.

Flexible cord has been freely used, and is all right if the best quality is used. For this purpose the conductors should be covered with rubber one-thirty-second inch thick, and the outside covering should be silk, or, if cotton, it should be slicked with a compound which makes it non-inflammable.

Rosettes designed for 110-120-volt circuits having fuses have given a good deal of trouble, so it has become good practice to leave out the fuse wire and put copper wire in its place, thus having no fuse between the lamp and the fuse block close to the switch controlling the circuit. The General Electric company has produced a new porcelain rosette which has fuse wires over one inch long; these have been severely tested, with very satisfactory results. Their use with fuses will give protection to individual lamps, which is very desirable, as it increases the safety of the wiring.

Fusible cut-outs designed for 110-120 volts, have failed in many instances, and have often proved much more fusible than their makers expected them to be. A complete line of fuse blocks carrying

FIG. 3. BUFFALO TRANSFORMER STATION — LARGE TRANSFORMERS.

special 200-240-volt fuses has been developed recently by the General Electric company. These are fitted with the cartridge type of fuse, the fuse being contained in a tube which is provided with brass terminals which fit in spring clips on the fuse block. The fuse wire is inside the tube and is soldered to the brass terminals. The tube is then filled with a plaster compound which smothers the arc formed when the fuse blows. These fuses have been severely tested with 500 volts and currents many times their rated capacities, and have always opened the circuits without a flash.

Standard knife switches or quick-acting snap switches, having large break distances, should be used. Such switches, specially designed for 200-240-volt installations, are now being developed.

Standard methods of wiring for 110-120 volts are approved for 220-240 volts. Good rubber-covered wire run on porcelain knobs or cleats is specified by the fire underwriters.

Good arc lamps burning two in series on 220-volt circuits are on the market. Each lamp is provided with an automatic cut-out which throws an equivalent resistance into the circuit when one lamp is extinguished, thus permitting the use of one lamp if desired.

The future of the 200-240-volt system depends largely upon the development of a more economical lamp. All other elements of the system can be made entirely satisfactory with the means and knowledge now at our command, but the production of a more economical lamp calls for an advance in the art of lamp manufacture. That this advance will be made and a more economical lamp will be produced, I have no doubt, and hope to see such a lamp placed upon the market at an early date.

By a unanimous vote the Common Council of Lockport, N. Y., has granted the Buffalo and Lockport Railway company a 47-year franchise to connect the tracks of the Erie road with the tracks of the Lock City electric railway.

John J. Flather.

The appointment of Prof. J. J. Flather as professor of mechanical engineering in the University of Minnesota at Minneapolis, which is announced, makes it appropriate to present a portrait and a brief sketch of the life of this successful engineer. For seven years Professor Flather has been professor of mechanical engineering in Purdue University at Lafayette, Ind., and during that time he has done much for the upbuilding of the department of mechanical engineering in that school, especially along the lines of steam engineering and machine design. He is the author of valuable technical treatises and is a man of high standing in his profession.

As an engineer Professor Flather possesses prac-

JOHN J. FLATHER.

tical experience as well as scientific and theoretical knowledge. He is a graduate of Yale and took a post-graduate course at Cornell, but he also spent several years in New England shops as machinist, foreman and superintendent. For three years he was instructor in mechanical engineering at Lehigh University, and in 1891 he was appointed to the position in Purdue University which he has just resigned. His work at Purdue attracted wide attention and made his name well known to engineers. He was popular with the student body at Purdue and made many friends among the citizens of Lafayette.

Professor Flather edited the American edition of Wilson's "Steam Boilers"—a work of acknowledged excellence. He is the author of "Dynamometers and the Measurement of Power" and of a comprehensive treatise on "Rope Driving." He has been a frequent contributor to the technical press. An important article from his pen on "Rules Governing the Width of Leather Belting" appeared in the Western Electrician of June 12, 1897. He is a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and treasurer of the Society for the Promotion of Engineering Education.

Brooklyn Lighting Interests.

It is announced that the absorption of the Edison Electric Illuminating company of Brooklyn by the new Kings County Electric Light and Power company has been accomplished. The details of the arrangements are now being made, and as soon as they are ratified by two-thirds of the stock of the Edison company will go into effect. The stockholders in the latter secure the right to subscribe for 25 per cent. of the additional stock to be issued at par. The increased holdings are then to be bought at par by the absorbing company, payment being made in 99-year six per cent. mortgage bonds, secured by all the stock of the Edison company, held in trust, a junior lien on all the property of the Kings County company and a cash guarantee fund of $1,000,000.

The Kings County company has recently laid many miles of underground wires and put in the lowest bid for street lighting in the borough of Brooklyn. The Edison company absorbed the Citizens' Electric company about four years ago. The report of the Edison company for June shows the following for the month and for the half-year:

Month of June.	1898.	1897.	Increases.
Gross earnings	$ 215,156	$ 172,861	$ 42,295
Operating expenses	135,721	109,656	26,065
Net earnings	$ 79,435	$ 63,205	$16,230
From January 1 to June 30.			
Gross earnings	$1,541,723	$1,228 766	$312,957
Operating expenses	856,515	657,051	199,404
Net earnings	$ 685,208	$ 571,715	$113,493

A. M. Young, who is president of the National Electric Light association, is the manager of the Kings County company, and under his direction it is anticipated that the consolidated interests will assume much greater importance than the old lighting plant aspired to.

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No wonder corporations tire of the unreasonable complaints that are constantly being made, and frequently proceed without regard for the wishes of others. While such proceeding is often unjust, it is not unnatural when the provocation is considered. In New York, for instance, the Sixth avenue merchants have been clamoring more than a year for the change of the motive power of the Sixth avenue surface railroad from horses to the underground trolley, assuming, of course, that the change would increase travel on the road and bring more customers to their shops. Now that the work is undertaken, under conditions which guarantee its completion in the shortest possible time, they again clamor against these conditions, involving, as they do, a temporary suspension of the car service. They want the trolley, but they don't want the roadway torn up. Great public improvements can only be made at great expenditure of time and money, and those who are to be benefited directly by the work should certainly show a disposition to put up with a little temporary inconvenience, annoyance and pecuniary loss if need be.

Attention is directed to the fact that all applications for patents now pending that were filed by employes of the Patent Office during the period of their service, either complete or incomplete, or completed after they had separated themselves from the service, are ordered to be stricken from the files and the fees returned. The commissioner has very decided views on this subject, and he will enforce them most rigidly. It is unnecessary to say that he will receive the enthusastic support of the patent bar and of the public as well. The wisdom of this course is apparent at a glance.

Rights of interurban railway companies were considered and carefully defined by the Supreme Court of Illinois in the decision handed down last week in an appeal by a number of property owners along Fox River, who denied the right of the Aurora and Geneva Railroad company to condemn property along the river under the Allen law. The lower court had held that the right of condemnation was as unlimited as the right given steam railways. An appeal was taken to the Supreme Court, and that tribunal reversed this finding, holding as follows: "There is a wide and well understood difference between a railroad organized for general traffic and a street, horse or dummy railroad. That a street railroad, like a steam railroad, may locate its route not for the accommodation of local travel, but to reduce time and distance for travelers from city to city or town to town, across the country, is a proposition not to be entertained."

The court admitted, however, that there were exceptional instances where, for example, highways and streets were impracticable. While the ruling may not affect the street-railway interests of Chicago, it is certainly of considerable importance to the interurban electric-railway lines which are being constructed in all parts of the state. These roads are built in many cases to compete with spur lines of steam railways between two or three towns.

Litigation involving the construction of the law providing for war-revenue tax and affecting the responsibilties of the telegraph companies has been undertaken in several places, but thus far the corporations have not been compelled to retire from their original positions. Justice Stover in the Supreme Court in Brooklyn, last week, refused to issue a writ of mandamus compelling the Western Union Telegraph company to transmit a telegram without making the sender affix a one-cent internal-revenue stamp. The complainant had visited the office of the telegraph company at Brooklyn, and presented a message to be sent to Greenport, L. I. The clerk asked the sender to affix a one-cent stamp to the message, and he declined to do so. As the message was refused he began the proceedings. His counsel said it was a question whether the sender must buy and affix the stamp or not. "That is something," said Justice Stover, "with which this court has nothing to do. A mandamus can only issue when the right of the party asking for it is clearly established. Such a right is not established here. The motion is denied with costs." According to the ruling of Internal Revenue Commissioner Scott, "a telegraphic dispatch or message is required to be stamped by the person who makes, signs, or issues it." Therefore it will probably require a ruling by the Supreme Court of the United States to compel the telegraph companies to assume this burden.

Municipalities have no right to impose restrictions upon corporations which are not warranted by law and when an attempt is made it is clearly an invasion of property rights and should be resisted as such. In the contest between the City of Chicago and one of the street-railway corporations controlled by Mr. Yerkes over the placing of street lamps upon the trolley poles of the railway company, the city is clearly in the wrong. Whatever opinion may be entertained regarding the wisdom of Mr. Yerkes' decision in refusing to grant the city permission to utilize the poles of his trolley lines for this purpose, there can be no doubt about his rights in the premises and his ability and determination to assert them. It would have been a gracious act upon the part of Mr. Yerkes, who has certainly enjoyed many privileges at the hands of the people of Chicago, to grant the city the privilege of placing street lamps upon the poles of his company, but as long as he did not see fit to grant permission the city had no authority to assume possession of the poles for this purpose and Mr. Yerkes will be upheld in his efforts to protect his rights. It may be possible that Mr. Yerkes was influenced somewhat in his decision by the fact that the plan proposed would considerably cheapen the cost of construction of the city lighting plant, and that this very fact would be urged against corporations hereafter. Mr. Yerkes does not believe in helping the advocates of "municipal ownership" to make a good showing, and they would certainly use it as an argument against the continuance of street-railway service in the hands of corporations.

Promoters of electric-power transmission projects will be interested in the reports from California regarding the failure of the water supply upon which the San Joaquin Electric company has depended for the operation of its plant. The San Francisco Chronicle publishes the following dispatch from Fresno under date of July 19th:

Fresno is in darkness to-night because of a lack of water in the North Fork of the San Joaquin River to generate power sufficient to run the plant of the San Joaquin Electric company to its full capacity. During the afternoon the customers of the company who are using motors learned that their power would be partially if not wholly cut off for a short time at least. The water is not sufficient for the company to supply its patrons with the usual service, which amounts to from 800 to 1,000 horse power. To-night the arc lights were cut off, and it is probable that in a week or so there will not be sufficient current to keep the incandescents going. The company promises, however, to make some arrangement to supply its customers with light, and, it is believed, it will take hold of the old electric-light company's plant and put it in condition. J. S. Eastwood, vice-president of the company, has returned from a trip to the power plant, 35 miles east of this city. He found a great shortage of water in the mountains, as many of the streams have dried up. The snow has disappeared and the springs have quit running. The north fork of the San Joaquin, where the power plant is located, is low, and the big reservoir, some 25 miles farther back in the hills, affords but little water.

The particulars contained in this dispatch indicate that an unusual condition prevails on the coast. It was common belief that the water power upon which the company depended was ample and reliable at all seasons of the year. When the plant was installed it was announced that "it has an unfailing supply of 50,000 horse power of water available."

Mr. Eastwood, mentioned in the dispatch already quoted, was the orginator of the enterprise which resulted in the formation of the San Joaquin Electric company and the transmission of electricity to Fresno for light and power. He is a civil engineer of high standing in Fresno, and was supposed to be familiar with the water power available throughout the coast region. It was upon his recommendation that the enterprise was taken up four years ago. The company was formed in April, 1895, and the plant installed in the following year. The company secured the city lighting contract and considerable commercial business before the plant was ready for operation, and it has since grown in public favor. The news of the present suspension of service is, therefore, a great surprise to the outside world. It should serve to impress engineers with the importance of carefully examining the conditions and records of the country upon which it is proposed to depend for water supply before investing in transmission plants. In the case of the San Joaquin plant it is said that the reservoir mentioned in the dispatch had an area of eight acres, and that "its storage capacity is sufficient to operate the transmission plant to full capacity for between five and six days." Concerning the tributaries to this reservoir it was said when the work was undertaken that "until well in the summer, each valley adds its quota of water to the stream, but only the waters from the larger canyons have perennial flow." It was not anticipated that difficulty would be experienced in securing the necessary water supply, as the streams never before were known to fail.

WAR NEWS.

Norman Taylor Harrington.—The readers of the Western Electrician will be interested in the portrait of Norman Harrington, which is herewith presented. Mr. Harrington is the Chicago engineer who stood side by side with Consul-general Bowen in Barcelona in front of the escutcheon of the American consulate in that city when the eagle and shield were threatened with destruction by an angry mob of Spaniards on April 20th. Mr. Harrington is now in this country, but it is Mr. Bowen who tells the story of his coolness and patriotism, as the young Chicagoan treats the matter lightly and laughs away all reference to it. Mr. Bowen says: "During the morning of April 20th a mob of 3,000 or 4,000 people suddenly filled the square in front of the consulate, cheering for Spain and uttering other cries. I was breakfasting at the hotel on the opposite side of the square. This mob had come determined to get the consulate eagle and shield. I managed to push my way through the people until I got my back to the consulate and faced the mob. There I awaited the result. I had hardly taken up my position when I noticed a man as big as myself (Mr. Bowen is about six feet high) pushing through the crowd. He came and stood beside me, did not speak, but faced the crowd, which continued to threaten us. Fortunately, the mob had no leader, so, for a quarter of an hour, we two and the mob faced each other. Then the police and soldiers arrived and the mob melted away. I asked the stranger who he was and he replied: 'I am Norman Harrington of Chicago. This is my first day in Barcelona. It seemed to me as if there would be some trouble for the eagle up there, and I thought I'd take a bit of it.'"

Mr. Harrington was born in Cleveland, and is 26 years of age. He was educated in the public schools of his native town and afterward took up the study of mechanical engineering in the Case School of Applied Sciences. He also studied in the engineering department of the University of Michigan, and in 1892 came to Chicago to accept a position in the office of the chief engineer of the Crane Elevator company. Two years ago he went with the E. P. Allis company, and was principally employed as erecting engineer. He has superintended the erection of steam-engine plants in many sections of the country. He was sent abroad by the Allis company to supervise the installation of power plants in several cities of Southern Europe. He erected an equipment of steam blowers in Trieste, Austria, and then traveled for several months until he was sent to Madrid and Barcelona. In these cities an English firm of contractors is erecting electric railways. Allis engines are used in the power houses, and Mr. Harrington set up the engines for the English contractors. It was in Barcelona that he showed his Americanism and his courage in the manner that has been described. Mr. Harrington's position in Spain thereafter, when war had actually been declared, was not a pleasant one, but he remained until the plant was almost completed, when the English contractors sent him away, not through apprehension for his personal safety so much as in the fear that the presence of an American would prejudice the Spaniards against the plant and perhaps tempt the hot-headed ones to wreck the machinery. Mr. Harrington returned to Chicago nearly a month ago. He makes his home with his parents, Mr. and Mrs. C. N. Harrington at Oak Park, but his business duties compel him to spend much of his time in Milwaukee and elsewhere.

Cutting Iloilo Cable.—The action of Admiral Dewey in cutting the Hongkong cable immediately after the destruction of the Spanish fleet under Admiral Montejo in Manila Bay has been followed by a general raid on all means of cable communication between Spain and her colonial possessions wherever they could be reached by the American forces. Admiral Dewey set a pace which Admiral Sampson by force of circumstances has been unable to sustain, although the latter has shown a disposition to do so. Admiral Dewey's operations in Manila Bay have not been followed as closely as those of the forces nearer home, but there is ample evidence that he has not only destroyed every means of direct communication with Madrid, but that he has also cut off the Spanish forces in Manila from all intercourse with other parts of the Philippine islands. One of the most important incidents of the operations at Manila was the cutting of the Iloilo cable in Manila bay at seven o'clock on the morning of May 23d. Iloilo is an important point on the island of Panay, almost directly south of Manila. The cable connecting these points was cut by the crew of the American transport Zafiro, which grappled the cable in Manila Bay. The accompanying illustration graphically represents the crew at work. The cut was made from a sketch drawn by John T. McCutcheon, the Chicago Record's artist with Admiral Dewey's fleet, and was kindly loaned by the Record for this reproduction. Aside from the natural interest in the event represented and the artistic merit of the sketch, the picture possesses historical value which will be appreciated especially by those who have been engaged in the movement for the adoption of an international agreement respecting the neutrality of submarine cables at all times.

War Tax on Telegrams.—Levy Mayer, the noted Chicago lawyer, has given his opinion to the Illinois Manufacturers' association to the effect that senders of telegrams must provide the war-tax stamp. Mr. Mayer's interesting opinion is summarized as follows:

In section 6 the imposition of the duty to pay the tax is placed upon "any person or persons, or party who shall make, sign or issue the same, or for whose use or benefit the same shall be made, signed or issued." This general language makes clear the intention of congress that in every conceivable case where a stamp is required the paper or document, however drawn, or wherever made, requires that someone shall pay the tax. In the case of telegraphic messages there seems to be no escape from the conclusion that "the person who shall make, sign or issue

NORMAN TAYLOR HARRINGTON.

the same, or for whose use or benefit the same shall be made, signed or issued," is the sender of the message. This conclusion marks an exception to the general plan of the act, which indicates clearly an intention that railroad, steamboat, express, insurance and other companies doing a general business should pay the tax in the first instance at least. Thus telephone companies are expressly charged with the payment of a tax on each message; life insurance companies doing business on the weekly payment plan, with a tax on the first premiums, and palace or parlor car companies with the payment of a tax on tickets issued by them. The specific provisions as to telegraphic messages require the construction that the sender must pay the tax. The telegraph company merely transmits the message presented by the sender. It is forbidden to do so unless a copy of such message has a stamp affixed thereon. Section 18 of the act provides that "if the company shall transmit to any person any dispatch or message without an adhesive stamp denoting the tax imposed by this act being affixed to a copy thereof, the company, its agent or employe in default incurs a penalty of $10. Such penalty is nominal compared to that prescribed for not affixing the stamp to a document requiring one. The "message" is the thing taxed in the words of the statute, not the transmission or the contract for its transmission, or any acknowledgment of its receipt for transmission. A telegraph message is necessarily "issued," that is, prepared, made and signed by the sender. It is his act, and the transmission of it is for his benefit. Relief in the premises, if relief be desired, must be sought at the hands of Congress.

The Signal Service.—It is said that the Illinois signal-service troops, now at Chickamauga, will take part in the Porto Rico expedition. The original order called for only the regular company, but the major in command requested that the entire corps be taken. Major Inman of Springfield and Captain McConnell and Captain Hoburn of Chicago have command of the three companies. The corps is about supplied with the varied equipment needed. It will probably be sent to Newport News for embarkation.

The collector of internal revenue at Chicago has received instructions from Commissioner Scott upon the application of the new war tax. The rulings upon telegraphic and telephonic business are as follows:

A telegraphic dispatch or message required to be stamped by the person who makes, signs or issues it.

Where telephone companies have lines extending into more than one collection district the return may be made to the collector of that district in which the principal business office of the company is located.

Contracts and agreements between subscribers and telephone companies for the placing of a telephone and payment therefor are not subject to stamp tax.

Volunteer Engineers.—Colonel Eugene Griffin of the General Electric company is in command of the First Regiment of Volunteer Engineers at Peekskill, N. Y. The mustering in, uniforming and equipping of the men is now practically complete. Lieut.-Col. E. J. Spencer of the Third Regiment of Volunteer Engineers, another well-known electrical man, was a recent visitor at the Peekskill camp.

Brig.-Gen. George L. Gillespie, commanding the Department of the East, has made an inspection of Camp Townsend, Peekskill, to find out in what shape and how effective is the regiment of engineers now in camp there. General Gillespie said that he was surprised to find in what excellent shape the regiment is. He said that the men not only know what is expected of them in engineering work (the majority of the regiment are graudate engineers), but have succeeded in making a remarkably good infantry regiment. General Gillespie said that every man in the regiment is anxious to get to the front, and that wherever the organization is sent it will give a good account of itself.

Lighting Harbors Resumed.—Since the order was given to remove the mines and torpedoes from the rivers and harbors of the United States, the lighthouse establishment has resumed lighting the Boston and Baltimore harbors and channels. The mines in Nantucket channel and those around Fort Monroe, it is understood, will not be taken up, but in both places the lighthouse service has not been disturbed, patrol boats being relied on to keep craft off the fields covered by the explosives. While the harbors were mined the lighting was discontinued.

Cable Communication With the West Indies.—General Shafter opened a cable office at Santiago on July 20th, and General Greely announced that "the cable to Santiago is now open to all the world, except Spain and her colonies. General Shafter has established a strict censorship and will not permit the sending of any news that might embarrass the United States in military operations or otherwise. Information will be held back concerning movement of troops to Porto Rico or elsewhere, and all other news which might be of value to the enemy. In Santiago General Shafter or his representative will be the sole judge of what news should not be sent. That city is now under military rule and military necessities will govern the use of the cable. General Shafter and his assistant, Major Green, will continue this censorship until changed conditions render greater freedom to the correspondents advisable."

The press censorship at Tampa has been abolished. Orders have been received from General Greely by Captain Brady, who has been the chief censor for the state, to make his headquarters at Jacksonville and to dismiss the censors at Key West, Miami and Tampa. At Jacksonville Captain Brady will assume general charge of the wires centering there, but the censorship to be exercised in future will not stop

[*Continued on page 66.*]

CUTTING ILOILO CABLE, GRAPPLED BY THE UNITED STATES SUPPLY TRANSPORT ZAFIRO IN MANILA BAY.

DEVELOPMENT OF THE TELEPHONE FIELD.

Bridging-bell Patent Litigation.

Independent telephone companies will be interested in the decision of Judge Buffington of the United States Circuit Court for the Western District of Pennsylvania, in the case of the Western Electric company of Chicago against the Millheim (Pa.) Electric Telephone company and others, which was handed down at Pittsburg last week, declaring the system used by the defendants an infringement of the bridging-bell patent of J. J. Carty, which is now owned by the complainant. The action was begun on November 4, 1896, testimony was taken at Chicago and the arguments submitted at Pittsburg on February 17, 1898. Barton & Brown appeared for the complainant and Stanley S. Stout conducted the defense.

The litigation is interesting, as it involves a system in common use by many small companies of the country, and it is feared that, should the decision stand, the exchanges employing this system will have to be remodeled to evade infringement. In the defense an attempt was made to show that the system known as bridging bells was not invented by Carty. In support of this contention a copy of the Western Electrician of September 20, 1890, was introduced, as it contained a report of a debate on the subject at the Detroit telephone convention, where Mr. Carty disclaimed any pretensions to the invention of bridging.

"We do not want to make any contention for a patent on bridging," he said. "Bridging apparatus is not new. It was advocated in a paper read at Minneapolis last year, and one of the first things that Mr. Hibbard did in the long-distance company was to throw out the looping arrangement and bridge the operators in. Down in Cape Cod they had these three-legged lines as long ago as I can remember, and we used to laugh at them, but it turns out that they are the right idea after all. It is a question of the design of the apparatus. We have succeeded in making this a practical thing. You can take any of these wires and quadruplex it, and you would never know who was talking."

On the other hand, counsel for complainant argued that the same report showed that the telephone men of the country were industriously engaged at the time in solving the problems involved in the use of a party line. The announcement of the result of Mr. Carty's efforts was followed by inquiries from all parts of the country, and it was evident that to these men at least the subject was still a perplexing study, although they should certainly be acquainted with the developments in this field. Mr. Carty related his experience in solving the problem. His attention was forcibly called to the subject while he was making some changes in the railroad service of the New York Central at Albany. The conditions were such that the company had found it impossible to operate its system until Mr. Carty, in the course of his experiments, hit upon the idea of introducing the bridging bell. He explained the details of the arrangement at the Detroit convention, and the discussion that followed was the most interesting feature of the meeting. The subject continued to attract the attention of the telephone experts of the country, and when on March 31, 1891, Mr. Carty procured a patent on the system which he had developed, it was generally recognized as a valuable advancement in the art. Judge Buffington was evidently impressed with this view of the case, as will be seen from the favorable character of the following opinion which accompanies the decision:

Judge Buffington's Opinion.

"This is a bill filed by the Western Electric company against the Millheim Electric Telephone company et al., for alleged infringement of letters patent No. 449,106, issued March 31, 1891, to John J. Carty for telephone circuit and apparatus, and now owned by complainant. The defences are lack of novelty and patentability. These defences failing, infringement is conceded. The apparatus in question was designed primarily for use on a multiple line. Prior to this patent it was customary to connect the call-bell magnets at the several stations in series in the main-line circuit, together with a normally shunted call-sending generator, and at each station to provide a switch which, when at rest, maintained the continuity of the main circuit through all the call-bell magnets and kept the circuit of the local transmitter battery open. When, however, the switch was changed—which was done when the receiver was taken from the hook for use—it disconnected or short-circuited the bell magnet or generator from the line and introduced in place thereof the telephonic transmitting and receiving instruments and closed the local battery circuit of the former. Though this switch change at the two communicating stations removed the bell magnets at such stations from the circuit, no such action took place at the other stations. Consequently the voice current had to traverse all the other magnet helices in the line and was much weakened, not only by the resistance of such magnets, but also by the counter electromotive forces or inductive resistances developed in each. These were so active and energetic as to hinder conversation, yet it was necessary that all bell magnets should be connected with the circuit, otherwise the several stations could not signal each other. It will be noted that in this system, which is called a series circuit, the component parts are so arranged that the current must pass through all its parts, one after another. It is so styled in contradistinction to a multiple circuit, which is one having two or more of its parts so arranged that the current divides, portions of it passing through parallel paths afforded by the several parts. The two systems may be thus illustrated: When incandescent lights are connected in multiple circuit, the current passes to one terminal of each of the lamps which are connected to one side of a circuit and then divides up, a portion passing through each lamp to the other side of the circuit, where all these portions are reunited. Where such lamps are connected in series, all the current must flow into the terminal of the first lamp and out at the other, and so on through the successive lamps.

"It also appeared impossible to obtain a perfect inductive balance in a metallic telephone circuit when the bell magnets and telephone were connected in series, and such inductive disturbances manifested themselves generally in annoyances and sometimes were so intense as to prevent conversation. Now it would seem that if, instead of the series-circuit connection for both call magnets and telephones, a multiple circuit or bridging connection, after the manner of the simplest form of incandescent lighting, was substituted these difficulties would be avoided, but the conditions were different, since in a telephone circuit each station is both a generating and a utilizing one at the same time. Therefore, the generating currents are likely to be short-circuited by the nearest bridge connection and thus fail to reach the more distant station which it is desired to signal. The additional fact that two diverse uses are to be made of the current at the same station, viz., signaling and transmission of sound, and that they are to be used interchangeably between all the stations, renders necessary the addition of other means and factors to simple mere parallel arrangements. To overcome these difficulties the patentee suggested a simple and efficient remedy. He adopted the multiple-circuit plan and at each station placed a permanent bridge in which he seated a bell magnet with a high coefficient of self-induction and of marked impedance. He also provided two other bridges, which were normally open and closed only when the station was in use. The generator bridge circuit was adapted to be closed while a call was being sent. The third or telephone bridge circuit was open when not in use but closed in multiple arc with its own bell magnet and, of course, with all others in the line, when in use. When the call generator is used at a station it forms a second bridge or cross connection between the wires in parallel circuit with the permanently closed bridge circuit of its own bell and all other bells on the line. Now, the natural tendency of the ringing current would be to short-circuit through its home call-bell bridge and possibly through the nearest other call-bell bridges. This, of course, is highly undesirable, as it is necessary that all of the call bells of the system should be operated by the call generator of each station. The tendency of the current to thus short-circuit is counteracted in Carty's system by the high self-induction and impedance of the bell magnet, which opposes the passage of the call current and effects a more even distribution of it through the bell magnets of the system. By virtue of numerous windings of the wire in the bell magnets the small portion of the call current passing exerts a marked magnetizing effect on the cores and thus secures a more spirited working of the call signal. The means employed in the device and the mode of operation is clearly stated by respondent's witness, Mr. Miller, who says:

"'I am acquainted with this patent. It shows and describes a method of attaching telephone instruments in multiple between the two sides of a line, whether this line be a metallic circuit or a grounded line. The call bells are each permanently bridged between the two sides of the line and are made of high resistance and retardation. The generator at each instrument is in a separate bridge circuit which is normally open, but closed when the generator is operated. The telephonic apparatus proper is in a third bridge circuit, which, like the generator circuit, is normally open. The telephone circuit of each instrument is automatically closed when the receiver is removed from its hook for use, and this operation also closes a local circuit containing the primary of the induction coil, the local battery and the transmitter. In order that there shall not be an undue leakage of the voice currents through the permanently bridge call-bell circuits, the magnets of these call bells are wound to a high resistance (usually a thousand ohms) and are also constructed in such manner that they will have a high coefficient of self-induction. When a generator at any one station is operated, it is connected across the two sides of the line in parallel with all of the call-bell magnets on the line. Part of the currents in this generator will, therefore, pass through each of the call-bell magnets on the line, thus causing them all to operate if the amount of the current generated is sufficient to accomplish this result. The successful operation of this system depends on the fact that a coil possessing a high coefficient of self-induction will transmit with comparative ease alternating or pulsating currents of low frequency, while it will form a practical barrier to similar currents having a very high frequency. The currents generated by the calling generator at any station are of sufficiently low frequency to pass with comparative ease through the call-bell magnets arranged along the line, while the rapidly alternating voice currents impressed upon the line by the telephonic apparatus at any station will be compelled to pass over the main line to the receiving station without being materially weakened by leakage through the call-bell magnets. At the receiving station these voice currents will pass through the telephone receiver and secondary coil of the induction coil, these being connected across the line at that station by virtue of the receiver being off its hook. This path through the receiving instrument is of comparatively low resistance and retardation, and thus practically takes all of the current from the distant station.'

"As we have stated, the patent is assailed as lacking novelty and patentability. The grant of this patent is prima facie proof of the novelty and patentability of the invention therein disclosed (see Seymour vs. Osborne, 11 Wallace 516, and cases cited in note to 3 Robinson on Patents, No. 1016), and in absence of countervailing proof to the contrary its prima facies must prevail. An examination of the many alleged anticipations does not disclose the particular combination here shown, or overcome such prima facies. If any or all of them might have suggested a combination of means and the placing of them in the relation shown in the device, it is not proven that anyone so placed them. None of the elements composing the combination are in themselves claimed to be new. It is the combination of them in new relations and the securing a new and useful result thereby that constitutes the basis on which the patent rests. It goes without saying that if each element of the combination can be found in the old art, if all of them abstractedly and separately considered perform the same function they did in the old art, this will not tend to defeat the old patent if the old individual elements are here brought into novel combination with each other and their conjoined functions produce a new result. Such novelty, if the change involves patentability, constitutes ground for a valid patent. It follows, therefore, that to find in the prior art each element in isolation, is not to anticipate the work of a patentee who by the inventive act first evolves combination out of isolation. In discussing the prior art, Mr. Miller, after describing the working of Carty's device as we have quoted, says: 'I find the principles governing the effects of coils having a high coefficient of self-induction upon currents of high and low frequencies to be very clearly stated in various text-books and patents prior to the filing of Mr. Carty's application.' The critical and intelligent analysis of the prior art by Mr. Miller warrants that conclusion, but it by no means follows that knowledge of those principles is an anticipation of a combination wherein those abstract principles are used in new concrete relations, and thus made to produce new results.

"Now none of these alleged anticipations show the device of Carty. Varley's English Patent, No. 1044, of 1870, simply states a principle made use of by Carty, but concededly old, and it is clear that Varley's application of that principle would not suggest to a mere improver the device of Carty. The German publication, 'Das Telephon' of 1886, shows, without reference to detail of construction, two sets of telephones, one connected in series, the other in multiple. Without reference to other matters it is sufficient to say that no use of high impedance bells is shown, and beyond the principle of multiple connection it has no inherently necessary feature in common with Carty.

"Attention is next called to the publication, 'The Telephone,' by Preece & Maier, London, 1889. Among other essential requirements to constitute such a prior publication as will defeat a patent it is essential that it contain a description of the complete and operative art or instrument so precise and so particular that any person skilled in the art to which the invention belongs can construct and operate it without experiments and without the exercise of inventive skill. Unless a publication possesses all these characteristics it does not place the invention in the possession of the public nor defeat the claim of the reinventor to a patent. Cohn vs. U. S. Corset company, 12 Blatch.; 225 Fed. Cases No. 2969; Seymour vs. Osborne, 11 Wallace 516, Walker on Patents; and the description must be read in the light of the then knowledge. Betts vs. Merton, L. R. 3 Ch. Ap. 429.

"Tested by these standards it is quite clear that this publication will not and should not avail to defeat this patent. It does not disclose the device of Carty. While it speaks of the electrical difficulties as 'very easily overcome by means of properly proportioned fixed resistance coils placed in the different sections of the circuit,' that 'the electromagnet inertia of the apparatus itself is here utilized' and that 'it operates the receiver, it chokes the current across the bridge and so makes the working currents pass along the line,' yet when we come to examine we find these 'properly proportioned fixed resistance coils' to be a very different thing from Carty's call-bell magnets. The former are only determined by tedious calculations made by tech-

nical men and must be adjusted to each individual line, while the high-impedance bell of Carty's can be installed on any suitable line without reference to its length or to the number or location of stations. Moreover, the book or its drawings do not disclose how the telephone transmitting and receiving devices or the call-current generator or the signal-receiving apparatus are used or adjusted with relation to each other or to the entire system. It is quite manifest from a detailed examination of the work that Carty's device was not given to the world by this publication, and it is equally clear from the statements of the authors themselves in a subsequent edition that they did not regard their system as anticipating or disclosing Carty's, if such statements were to be regarded as competent.

"The other devices which are stated by respondents' witness to most nearly approach the Carty device are the divided circuit for clearing out annunciators, No. 300,144 of Scribner, and the Van Rysselberghe devices for combined telegraphic and telephonic service, patents Nos. 306,665 and 322,239. Using the method pointed out in the Scribner patent, we are unable to find any anticipation of Carty's device. Scribner's device was for effecting a connection in series between two subscribers through an exchange station and affording means for signaling such exchange when the conversation was finished, that the connection might be broken. This connection was through a clearing-out drop and this was of as low impedance as possible. Nowhere is the use of a high-impedance bell suggested and the proof is if it were substituted for the magnet of Scribner's device it would render talking impracticable. The bridging system of the Carty patent involved a definite and peculiar arrangement of different apparatus, operating in an original combination, to effect one specific result, while the Scribner device showed normally and designedly a different arrangement of apparatus in a wholly different mode of operation, to secure a result wholly different. Scribner's device was not intended for bridging a party-line system. To be forced to use the elements Scribner used in such reformed, variant and abnormal relations as are not fairly disclosed by his patent in order to approach to anything akin to likeness of Carty, tends to prove absence rather than presence of anticipation in the earlier patent. The Van Rysselberghe patents refer to a joint telephonic and telegraphic system. We do not find the Carty combination there employed. The system shows no call-signaling apparatus whatever. On this point defendants' expert says: 'The telephone instrument 20 here shown is represented by a receiver only, but there can be no question whatever but that a battery transmitter is also used, and very probably additional signaling instruments for those telephone instruments also.' But to show anticipation and strike down a patent we should have something more certain than probabilities. The call-signaling apparatus of the Carty system is so vital to its use that either it or its substantial equivalent should be found in the alleged anticipation to constitute it a real anticipation. It would seem that the two systems were for different purposes and their methods were diverse in detail. Moreover the Van Rysselberghe system was for the simultaneous transmission of telephone voice currents and telegraphic-signaling currents. The Carty system of sending call signals could not be used in connection with Van Rysselberghe's systems. It is therefore apparent that in no fair sense can it be said that Carty's device was anticipated and given to the world by Van Rysselberghe's. Being therefore of opinion that the defences alleged have not been made good, a decree should be prepared in favor of the complainant."

Telephony in Russia.

A report has been prepared by the Russian postal and telegraph administration for the year 1897 explaining the present position of telephony in that country. The telephones are partly worked by the Bell company and partly by the state, but it would appear that, as usual, where an arrangement of this kind exists, the former has managed to occupy the most remunerative areas, for while the number of subscribers to the two systems is nearly the same (11,171 and 10,419 respectively) the company works 11 districts in which there are 15 exchanges, and the government business is divided over 67 districts with 80 exchanges. The state owns 2,875 miles of lines, corresponding to 15,130 miles of conductor, and has 11,616 telephones in use. The length of the company's lines is 848 miles, and the length of conductor is 15,580 miles. The proportion of these figures is explained by the fact that the company's areas include the large towns of St. Petersburg, Moscow, Warsaw, Odessa, Riga and Lodz. Concessions for all but the last mentioned of these towns were granted in 1882; for Lodz in 1884. No new concessions have been granted by the government since the year 1886, and on November 1, 1901, the state will acquire the whole system.

There are public call offices in several towns, the charge, according to the London Electrician, for a three-minutes' conversation being 5.7d. for conversations with local subscribers, 11.4d. through trunk lines up to a distance of about 33 miles, and 1s. 7d. up to a distance of about 65 miles. The trunk lines between Odessa-Nikolaieff, Rostoff-Taganrog and St. Petersburg-Terrioki have produced a revenue of £4,300. The work of erecting the trunk line from St. Petersburg to Moscow was resumed in the spring. The charge for a three-minutes' conversation will be 4s. 9d., and a person will be allowed the immediate use of the line, out of his proper turn, for a triple fee.

The relations between the electric-railway companies and the telephone system are clearly established. When an electric railway is started in a town the telephone wires are altered to prevent disturbance in them, and the cost of this is charged to the railway company.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Conway Telephone company is preparing to occupy a brick block, now in course of erection at Blockton, Iowa, for a telephone exchange.

The Winard Telephone company has been granted a right of way through Hamilton, Ill.

The Iowa Telephone company is getting materials on the ground for a telephone line from Onawa to Mapleton, Iowa.

The Sunset Telephone and Telegraph company has been granted a franchise in Seattle, Wash.

R. K. McGee and D. F. Hurst will construct a telephone line from New Virginia, Iowa, to Medora.

Merchants of Bankston, Iowa, and Tivoli propose to construct a telephone line to Dubuque.

The Bishop Telephone company has been granted a right to establish a toll connection with Belle Plaine, Iowa.

The Iowa Telephone company is preparing to remove its office in Muscatine, Iowa, to better quarters.

D. B. Freil, a lineman for the Northwestern Telephone Exchange company in Minneapolis, while working on a pole, touched a live wire, receiving a severe shock which rendered him unconscious. A policeman turned in a fire alarm and the unfortunate man was rescued by the hook and ladder truck. Several doctors worked over Freil for some time before he was pronounced out of danger.

H. H. Heath has just completed a telephone exchange system at Greenwood, Wis.

The telephone company at Dubuque, Iowa, appealed to the courts for an injunction restraining the Sullivan heirs and the City Council from interfering in any manner with a large pole which the company recently erected by stealth in front of the Sullivan property. The court granted the injunction against the Sullivan heirs, but declined to include the City Council.

A telephone extension is in progress from Clinton, Iowa, to Charlotte, Iowa.

It is reported that the council of Des Moines, Iowa, will pass on a franchise for the Iowa Telephone company, and bring suit in the state courts to compel its acceptance. The franchise provides for maximum charges of $42 and $28 for business and residence service, and has a clause that, if at any time the company cuts rates, the lower rate shall thereafter be the maximum rate. A decreased rate is provided for as the number of instruments used increases.

The Wisconsin Telephone company is preparing to change its system at Rhinelander, Wis., from automatic to a central office.

A telephone line from Belle Fourche, S. D., to Aladdin, is proposed by the Hay Creek company. Contracts have been let for 600 poles.

The Iowa Telephone company has been granted a franchise for an exchange at Prairie City, Iowa. The Central Telephone company is also building toward that place as fast as possible.

The Minnesota Central Telephone company will probably extend its wires to Clarkfield, Minn., soon.

The Mutual Telephone company is arranging to open an office at Ames, Iowa, on its line from Boone to Marshalltown.

The telephone company at Denison, Iowa, was put to considerable trouble by a bullet in the cable entering the central office. This let water into the wires and crossed the entire strand.

The new telephone exchange at Humeston, Iowa, has been completed and put in operation.

The Cedar Valley Telephone company has been negotiating for several weeks to secure the Tama and Toledo telephone system, but has been unable to come to terms with the owners. The Cedar Valley company will instead build a line to Tama from Elberon.

The Western Electric Telephone company expects to connect St. Peter and Mankato, Minn., shortly

Bayfield, Wis., complains that its acquaintance with the long-distance telephone was short and unsatisfying. The connection was completed and shortly after a storm played havoc with the wires. That was three months ago, and the line has not yet been repaired.

The Northwestern Telephone Exchange company advises Graceville, Minn., that it will extend long-distance service to that town if the business will warrant it.

Britton, S. D., will soon have long-distance telephone service.

The Dakota Central Telephone company has completed its system to Watertown, S. D., and soon expects to make connections with the Minnesota Central Telephone company, which covers Minnesota.

A telephone line is projected at Miller, S. D., to Kimball, via Gannvalley.

Extensions and Improvements.

Spokane, Wash., hopes to have communication with Greenwood camp by telephone within a short time.

According to the San Bernardino [illegible] of July 1st, "the people of Etiwanda will build their own telephone line for the free use of the public."

The New York Telephone company will open an exchange in the village of Manorville on August 1st. The office will be in the bank building, Boston Post Road.

Luther Green, Dr. J. H. Lacy and E. T. Ijams of Safford, Arizona, have formed a company to build and operate a telephone line in Graham County, from Pima to Solomonville.

The Southwestern Telegraph and Telephone company has elected Thomas Sherwin of Boston and David B. Parker of Buffalo directors to represent the American Bell interests in the company.

A company will be formed at Groveland, N. Y., to erect a telephone line from the Delaware, Lackawanna and Western Railroad company's station to Scottsburg, thence to Groveland Corners, East Groveland and Long Point on Conesus Lake.

An ordinance has been passed by the trustees of Whittier, Cal., granting the Sunset Telephone and Telegraph company the right to place, erect and maintain poles, wires, etc., for transmission of electricity for telephone and telegraph purposes along streets of that village.

The Columbia and Montour Telephone company has been formed by merchants of Shamokin, Sunbury, Danville and Bloomsburg, Pa., with a capital stock of $500,000. The new company will compete with the Bell company, by leasing lines in Lycoming, Northumberland, Montour and Columbia counties. The main office will be at Danville.

The Citizens' Telephone company of Laconia, N. H., has selected the following-named directors for the ensuing year: True E. Prescott, Henry J. Odell, Edmund Little, Dr. Alfred W. Abbott, John W. Ashman, John H. Dow of that city, Herman J. Odell of Franklin, William B. Fellows and Frank Proctor of Tilton. It was decided to declare a semi-annual dividend of three per cent.

The telephone has been called into play in securing the release of a convict in the state prison at Trenton, N. J. The Court of Pardons met at Trenton, but Governor Voorhees was at the military camp at Sea Girt. The transactions of the court were carried on by telephone, and the attorney-general of the state rendered the opinion that Governor Voorhees' consent to the pardon by telephone would be valid.

The Erie Telegraph and Telephone company has elected the following-named directors: C. E. Adams, Charles J. Glidden, J. W. C. Pickering, Asa C. Russell, Levi Sprague and J. H. Mills (in place of Abner S. Adams, deceased) of Lowell; W. A. Gove, David S. Greenough and Charles S. Tuckerman of Boston; Harvey A. Whiting of Wilton, N. H.; Henry D. W. Burt and H. Fred Stevens of New York. The board of directors elected the following-named officers: President, Charles J. Glidden; secretary, George B. Perham; treasurer, Charles A. Grant; general manager, James P. McKinstry.

The use of the telephone throughout Norway shows considerable development. For the first 11 months of 1897 the conversations through the state telephones numbered 321,989, compared with 105,471 for the whole of 1896. The telephone companies in Norway also report considerable development. The number of conversations through the chief central stations of the Christiania Telephone company in 1897 reached 17,600,000, an average of about 10 conversations per telephone per working day. Interurban telephonic communication has recently undergone considerable extension, the additions for 1897 including the towns of Hamar, Gjovik and other places as far west as Flekkefjord.

A communication has been filed with the Board of Supervisors at San Francisco, Cal., by Herman de Laguna demanding that that body enforce at once the terms of an agreement entered into with the People's Mutual Telephone company when that corporation was granted a franchise in 1896. One of its provisions was that the city should have free telephones and thus save $15,000 a year for telephone service. One day prior to the expiration of the franchise, November 16, 1897, a renewal was obtained, a bond of $10,000 being furnished to guarantee that the new telephone system would be completed within one year. According to Mr. de Laguna nothing has been done to carry out the contract, and he suggests that the board, as a matter of legal protection, make a formal demand on the grantee to furnish a specified number of telephones, to be installed in certain designated places, so as to lay a foundation for a suit to compel the payment of the bond in the event that compliance is not made with the order and the terms of the agreement. Attorney James L. Crittenden is the president of the new company.

WAR NEWS.

[Continued from page 65.]

information being sent out regarding the movements of the army or navy.

Signal officers say it will be almost impossible to grapple the San Juan cable, although General Greely has ordered that the effort be made. The cable is laid in water only 20 or 30 fathoms deep off San Juan, but its exact location is not known.

Removing River Mines.—The work of removing the submarine mines from the rivers and harbors of the Atlantic seaboard has been pushed vigorously under direction of the War Department. It was interesting work, and as considerable danger attended the removal of these obstacles to navigation, as much secrecy as possible was thrown about the undertaking. No one was allowed to accompany the boats, and only distant views could be obtained of the mines and the operation of hauling them up. The cables were cut which had connected the queer looking, oval-shaped pots filled with dynamite or gun-cotton with an underground apartment back of the forts, in which the keyboard containing the mechanism for discharging them was located. The mines were located by the chart furnished by Col. Allen, and the work of fishing them out of the water and transporting them to the fort was begun. It was dangerous work, and the engineers employed went about it gingerly. As the mines were taken up they were piled carefully on the forward deck of the snag-boat, covered with several thicknesses of canvas, and kept wet, to prevent the heat of the sun from affecting them.

Two mines were exploded in Boston harbor near Fort Independence on July 22d. On the pier at City Point there were several thousand people who had gathered to watch the explosions. Mrs. Mansfield, wife of Colonel Mansfield, turned on the current. Almost instantaneously a huge mass of water rose in the air, followed by a sullen roar, which was like the report of a great cannon heard from a distance. The water lifted into the air resembled a huge fountain 200 feet high, snow-white and shaped like a fleur-de-lis, the column in the center rising fully 50 feet above the body of the water. After the explosion many dead or stunned fish could be seen on the surface for a radius of 500 feet. The mines contained 100 pounds of dynamite and 50 pounds of gelatine.

When the American forces took possession of Santiago Spanish officers volunteered to help remove or explode the mines in the harbor. They said that there were six dangerous ones, and that four had been exploded against the Merrimac. There were also some contact mines to the right of the Merrimac going in. The officers said that the mines to the left of the Merrimac had been removed to let Admiral Cervera's fleet out. Lieutenant Capehart, with some other officers, was sent in to explode the mines. Half a dozen launches from the warships accompanied them.

Miscellaneous Notes.—One of the first of Santiago's local industries to be resumed after the surrender of the city to the Americans was the electric-lighting plant.

W. L. Shepherd of the Postal Telegraph-cable company, who is seriously ill with typhoid fever, has been sent home from Santiago on a hospital ship.

Another Underground Electric Railway for London.

[From the Railroad Gazette.]

The English investing public has just had before it the prospectus of the Great Northern and City Railway company. The capital of the concern is nearly $8,000,000. The board is composed of such eminent railroad men as Sir Charles Scotter, Sir Allen Sarle, Colonel R. Williams, M. P., and Sir Francis Knollys, K. C. M. G., K. C. B. The railroad is to run in direct connection with the Great Northern railway, to afford a short through communication between Finsbury Park Station, in the suburbs of London, where the various suburban lines of the Great Northern converge, and Moorgate street in the city of London. The length will be three miles, and the railroad, which will be in duplicate tunnels 16 feet in diameter, will be operated by electricity. The tunnels will take the heaviest suburban steam trains of the Great Northern Railway company, consisting of 11 vehicles, with a capacity of 500 passengers. There is an arrangement made between the Great Northern Railway company and the new company, whereby the former pays over a certain sum for the right to use the tunnels and for the maintenance of the city terminus. The trains will do the journey within 12 minutes.

The directors, in estimating the probable receipts, calculate on a daily service of 125 trains each way, but as other lines serving similar purposes run twice the number, the estimates should be well within the mark. The Metropolitan Railway company runs daily through King's Cross 265 trains each way, the Metropolitan District 278 trains each way through Victoria, and the South London electric railroad 220 trains each way for its purely local traffic.

A contract has been entered into with S. Pearson & Son, Ltd., for building and equipping the railroad and works, including all buildings, rolling stock, electrical installation, motors, etc. The contractors take all responsibility for compensation and damage by tunneling or other operations, and will hand the whole concern over to the company when completed, fully equipped with rolling stock and in working order. They will also work the railroad for three years under agreement, they guaranteeing four per cent. on about $4,000,000 of the ordinary shares for three years after the opening of the line.

Dangers from Electric Appliances in Coal Mines.[1]

In recent issues of Gluckauf and the Elektrotechnische Zeitschritt elaborate accounts have been given of a series of experiments conducted in the testing gallery at Gelsenkirchen in Germany recently. The tests were made in the three months, September-November, 1897, under charge of Herr Heise, representing the association of the Westphalian coal operators, and Herr Thiem on behalf of Siemens & Halske of Berlin, who supplied the apparatus. The testing gallery is of elliptical section 4½ feet wide, six feet high, has a length of 110 feet, is closed at one end and open at the other, and with three layers of pitch pine. Along the top runs a line of safety holes, covered with stout paper, and one side is provided with 15 windows of strong glass. For the present experiments the explosive chamber at the end of the passage, of 350 cubic feet capacity, and provided with three safety holes and four windows, was alone used. The methane gas comes from an abandoned poor working, which has been dammed off and fitted with a ventilating pipe to relieve the gas pressure. A branch of this pipe leads to the explosive chamber. The gas thus introduced contains on an average 38 per cent of methane. A gas meter is inserted in the pipe, and the flow regulated in such a way that, as a rule, a six per cent. mixture was obtained; an additional quantity of gas brought the percentage up to 9 or 9.5. The latter mixture is highly explosive, the former faintly so. Artificial coal dust, ground coal, was used.

The incandescent-lamp tests were the most complete. Naked filament raised to high incandescence may or may not cause explosion, and may remain intact and continue to burn after explosion; in most cases ignition seemed to follow the breakage or burning of the filament and the sparking accompanying it as a rule. Lamps with their bulbs were fixed on iron rods suspended on cords manipulated from outside, and dropped on the iron floor or shattered against an iron frame or the wooden wall. At first glance the 200 experiments seem to permit of no conclusion. Bulbs and filaments broke simultaneously, there was bad sparking and sometimes explosion, and sometimes not. In other instances the filaments remained intact, when the bulb was smashed and again explosion might follow or not. It is true that practically only the short, thick filament of portable lamps will bear this maltreatment. It is, however, not the mechanical strength only, nor the watts that must be considered. The amperes seem to be the chief thing. Currents of less than 0.6 ampere, continuous or alternating, did not produce ignition, though there was often sparking; stronger currents did. The explanation advanced when a bulb is broken, for instance, by carefully removing the top the air will rush into the vacuum expand, and cool the filament. This cooling is quite noticeable with thin filaments. If the so-cooled filament is broken, the methane, which requires a high temperature for explosion, will not flash up. In eight cases the tips were thus nipped off; the lamps darkened, brightened up again, and an explosion ensued. In one instance such a mutilated lamp was afterward smashed; a violent explosion ensued immediately, because there could not be cooling under these circumstances. Other lamps had their tips broken off, and were then only switched on after some time. The filaments developed light spots, burned through, but no harm was done; the experimenters argue that this immunity was the result of the hot filament decomposing the gas.

The conclusions as to lamps are: Use stout globes round the bulbs, to prevent cracking from water dripping on the hot bulbs, and for further protection, cages. Take low-current lamps (0.6 ampere-maximum) and high voltage, but not above 150 volts; all excessive volts are dangerous. Have short leading-in wires far apart, lest they be bent together and make short-circuit. Avoid, for the same reason, lamps with two filaments in series. This summing up is against the common portable lamp, which has the further disadvantage of not indicating the presence of fire-damp. Otherwise, electric incandescent lamps are recommended, as affording probably the safest illumination. Not much was done with arc lamps. They do not appear to ignite coal-dust, even in an atmosphere of four per cent. of methane; but in six per cent. explosions took place, whether the lamp was already burning or was switched in. A dust storm did not make the arc flare up. But arc lamps, continuous and alternating alike, must be condemned in fiery mines.

As regards switches for one or more lamps, current strength and still more so, voltage and self-induction in the circuit play a great part. While in general slow switching in is more dangerous on account of arcs forming, for circuits with high self-induction, continuous or alternating, rapid motion of the switch is to be avoided. In some cases the switch was thrown 30 times before ignition occurred. Carbon points may be glowing without causing explosion, as long as there is no arc. Spark extinguishers which form a momentary arc are to be condemned. Hot-wire resistances seem in themselves harmless, but danger threatens from contacts. A set of resistances was placed horizontally and one hot spiral touched another, when immediately explosion followed. Glowing wires do not cause explosions, even when the explosive atmosphere was driven through them by means of a fan. Melting wires, especially copper, may ignite the gas; but an iron wire buried in coal dust and heated by the current until it arced strongly, would not ignite the dust, either when it was quiet, or when it was stirred into a cloud. Fusing wires protected by a shunt may be considered harmless; but ordinary safety fuses of lead and tin behaved badly. Of electric motors, larger sizes are safer than smaller types, because variations in the load affect them less. Carbon brushes are least likely to do harm, because they spark so little. A motor placed in a box under a fine wire-gauze cover set fire to the explosive mixture in the box on starting; but the flame did not strike through the gauze. Experiments with five horse power tri-phase motors were quite satisfactory; a brush was 30 times lifted off one of the contact rings of such a motor without any mischief resulting. There might have been explosion with very abrupt changes in the load; to avoid any danger the motor should be encased, and double brushes should be used.

The general conclusions of the report are that electric apparatus is safe when ordinary precautions are employed in the mine.

1. From the Engineering and Mining Journal.

American Association for the Advancement of Science.

The fiftieth anniversary of the American Association for the Advancement of Science will be celebrated at Boston by a meeting on August 22d-27th. The preparations for the sessions of Section D, which comprises mechanical science and engineering, are proceeding under the direction of the vice-president and chairman of the section, Prof. M. E. Cooley of the University of Michigan, at Ann Arbor, Mich., and Prof. John Galbraith of Toronto, who is acting chairman. The secretary of the section is Prof. W. S. Aldrich of the University of West Virginia, Morganstown, W. Va., and Prof. John J. Flather of Lafayette, Ind., is the acting secretary.

It has been arranged that the meetings of Section D shall be held at room 27, Rogers building. On Monday, August 22d, the section will meet for organization immediately after the adjournment of the morning general session of the association, and at 4:30 p. m. Vice-President Cooley will deliver his address. The subject is yet to be announced. On Tuesday, August 23d, the regular programme will be taken up, and during the several sessions the following papers will be read:

"High-speed Influence Machines." By Charles W. Warner, Cambridge, Mass.

"The Development of the Topographic Work of United States Geological Survey and Its Application to the Solution of Economic and Engineering Problems." By Charles D. Walcott, Washington, D. C.

"Instruments and Methods of Hydrographic Measurements by the United States Geological Survey." By F. H. Howell, Washington, D. C.

"Proposed Methods of Determining the Frequency of Alternating Currents." By Carl Kinsley, Falls Church, Va.

"On the Efficiency of Refrigerating Plants." By Prof. Storm Bull, Madison, Wis.

"Some Experiments on a New Form of Impact Testing Machine." By Prof. W. K. Matt, Lafayette, Ind.

"On a Dynamometer Car and Its Equipment." By Prof. L. P. Breckenridge, Champaign, Ill.

"An Integrating Dynamometer for Measuring the Work Done in Drawing a Train." By Prof. Thomas Gray, Terre Haute, Ind.

"A Combined Absorption and Transmission Dynamometer for Laboratory Purposes." By Prof. J. J. Flather, Lafayette, Ind.

"On the Measurement of Train Resistance by Dynamometer." By Prof. F. C. Wagner, Terre Haute, Ind.

"On the Use of Platinum Resistance as a Pyrometer in Boiler Tests." By Prof. F. C. Wagner, Terre Haute, Ind.

"A Comparison of the Efficiency of the Rheostat and the Series Parallel Controller for Electric Cars." By Prof. Thomas Gray, Terre Haute, Ind.

"Note on a Curious Example of Elastic Eolotropy in Steel." By Prof. Thomas Gray, Terre Haute, Ind.

Other papers will be presented, the subjects of which will be announced later.

The Fergus Telephone company of Fergus Falls, Minn., has been granted a franchise in Pelican Rapids, Minn.

Russell & Officer Automatic Switch.

The Western Electric company calls attention to the improved Russell & Officer automatic switch, which it manufactures and which is represented in Fig. 1. This switch consists, essentially, of a pair of solenoids, which act on a common iron core. This core carries in turn the switch blades which are pulled into or out of engagement with the clips, depending upon the solenoid energized. The circuit from each solenoid is passed through the circuit-breaking device shown at each end of the switch, and is broken at this point as soon as the switch has acted and before the pressure can be removed from the push button. By this means the tendency to arc at the push-button contacts is entirely overcome, and there is no mark at these contacts, no matter how quickly the switch may be operated.

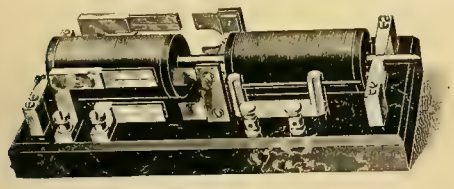


FIG. 1. RUSSELL & OFFICER AUTOMATIC SWITCH.

The advantages claimed for the switch are numerous and are itemized as follows: The control of a large number of lights by means of a push-button switch, and without having to bring the main wire supplying these lights to the switch itself, a No. 16 B. & S. gauge wire answering the purpose for any size switch; control of a group of lights from any number of points independently of each other; control of all lights in large rooms or buildings from a central point; the fact that the switch can also be used as an underload or overload switch when provided with a special relay; the simplicity of the switch, the magnets being operated from the electric-lighting circuit, and there being no batteries to get out of order or cause trouble.

The push-button plates used to operate this switch have black and white buttons and are so constructed that they can be used either where wiring is carried in iron-armored conduit or where it is carried in molding. In the first case the push buttons are mounted directly in a box of the same character and design as a flush switch box. In the latter case they can be placed in a wooden mat.

In connecting the switch, branches are carried from the branch main to the terminals A and A^1 (Fig. 2), and the lamp circuit is connected to terminals B and B^1. The controlling wires for the push-button wire (which may be No. 14 or No. 16 B. & S. gauge) are carried as follows: One wire is carried from terminal A of the switch, or from any point of the wiring system feeding this pole of the switch, to the center connection of the push button, marked F; one wire leads from binding post D to the connection E on the push button, which is on the same end as the black button; the other wire is carried from binding post C to terminal G on the push button, which is on the same end as the white button. When connected up in this manner, by pressing the black button the lights are extinguished, and by pressing the white button they are lighted.

Consolidation of Chicago Street Railways Proposed.

The recent transfer of Chicago street-railway securities in New York has revived the report that a consolidation of the street-railway properties of this city is now contemplated. It is announced that L. Z. Leiter, S. B. Cobb, Marshall Field, P. D. Armour, the Traders' Insurance company and William B. Walker, holders of the City Railway securities, favor an immediate merger with the North Chicago and West Chicago street-railway lines. C. T. Yerkes has submitted his figures, and the latter are now under discussion. It is understood that the new organization will be capitalized at about $50,000,000, the shareholders of the North Side and the City railway to be treated equally in the distribution of the new stock, while the West Side certificates are to be appraised at par.

FIG. 2. RUSSELL & OFFICER AUTOMATIC SWITCH.

Mr. Leiter is the largest individual holder of City Railway stock, as he owns to-day 8,000 shares. Mr. Cobb comes next with 6,000 shares, and Mr. Pearsons follows next with 4,000, while Mr. Field, Mr. Armour and the Traders' Insurance company hold large amounts. It is claimed that 50,000 shares have been pledged to the deal. The companies concerned are capitalized as follows:

Chicago City Railway company.—Stock, $12,000,000; bonds, $4,619,500; total, $16,619,500.

North Chicago system.—Stock, $6,849,900; bonds; $7,931,000; total, $14,780,900.

West Chicago system.—Stock, $14,083,900; bonds, $17,774,000; total, $31,857,900.

Standard Diagrams of Electrical Apparatus

Apropos of Prof. Andrew Jamieson's suggestions for changes from the Chicago Electrical association's standard diagrams for electrical apparatus, as given in the Western Electrician of July 16th, W. Clyde Jones, the patent attorney, has, at the request of Thomas G. Grier, chairman of the committee of the Chicago Electrical association, given the following interesting opinion:

As to the criticism of the diagrams of series shunt and compound-wound dynamos or motors, I do not consider them material. In the first place, I do not think that any distinction should be observed between zigzag lines and loops as representing magnetic coils such as the field coils of a dynamo or motor. I think they should be used interchangeably, if both are to be used, although I think the zigzag line is preferable as being more easily drawn as well as being more accurate, since there is a tendency to draw the loop coil by hand, thereby producing an untidy appearance.

As to the second criticism, relative to the location of the series winding. I think the committee's diagram is preferable to that of Professor Jamieson, since the winding in the latter's diagram is liable to be mistaken for a rheostat or a fixed resistance in the external circuit, while the location of the winding in the committee's diagram leaves no room for mistake as to this point. I think it might be an improvement in the committee's diagram to provide upon the conductors leading from the machine a pair of circles or heavy dots to represent the terminals of the machine, thereby indicating that all of the windings are within the terminals of the machine.

As to the motor-generator, I think Professor Jamieson's suggestion is much the preferable. I have never been able to quite comprehend the advantage of the motor-generator diagram as suggested by the committee, and whenever I look at it my thoughts wander off to long past days when I played with spools and toy wagons.

As to the diagram of the storage cell, I think that there can be no question but that the committee's diagram is the proper one, since the one suggested by Professor Jamieson is the usual diagram for a primary battery and the employment of a letter to indicate whether the battery is primary or secondary is objectionable, as it is desirable as far as possible to make the diagram speak for itself.

I think the committee's diagram of a constantly driven magneto is proper, in that it shows the belt to distinguish the magneto from a hand-driven magneto which would be shown in connection with a crank. Professor Jamieson's diagram conveys no information as to whether the magneto is constantly driven or hand driven.

As to the various meter diagrams, I think the committee's suggestion, wherein the letters are placed within the circle, are preferable, since the small letters placed outside the circle are liable to be confused with the reference letters that may be used for indicating the several parts of the diagram.

As to the inductive resistance, I think the committee's diagram is preferable, since the presence of an iron core is at once suggestive of inductive resistance, while the looped coil is not suggestive, and, as I have already stated, it seems to me that it is unwise to draw a distinction between a coil represented by zigzag lines and one represented by loops.

As to the solenoid diagram, I think the presence of a core is essential to render the diagram distinctive. Professor Jamieson's suggestion indicates a dead resistance quite as much as the solenoid.

The committee's diagram of a ground I consider much the preferable to the arrow employed by Professor Jamieson.

As to the diagram of the arc lamps, I think there are many instances where Professor Jamieson's diagram is preferable to the crosses employed by the committee, and I think both of these forms ought to be adopted, or, if it is necessary to discard one, I should preferably retain the one suggested by Professor Jamieson.

As to the diagram of the incandescent lamp it seems that both are good forms, but I should say that the one suggested by the committee is preferable, as it is more readily drawn.

As to the diagram of the fuse, I prefer the solid line, since dotted lines are often employed in diagrams to indicate modifications in the circuit arrangements, and the adoption of a dotted line for a fuse would thus lead to confusion.

As to the telegraph key, the committee's diagram is more complete, but I do not see much choice between the two forms suggested.

As to the transformer diagram, I consider that there is not much preference of one over the other, although the one formed of zigzag lines is more readily constructed and is the neater of the two, since the loops are usually made free hand and, therefore, present a somewhat untidy appearance. Furthermore, the employment of zigzag lines permits a more ready illustration of the difference in the number of turns in the primary and secondary conductors.

Honors for Distinguished Public Service

An interesting subject is that which deal with the anomalous condition of this country in the matter of honors or decorations for its distinguished men. It is considered in a recent report of a special committee of the Board of Regents of the University of the State of New York. The report was written by Whitelaw Reid and concurred in by Chancellor Upson and Bishop Doane. Inasmuch as it refers to the position of the electrical inventor in this matter, it will be followed with interest by the readers of the Western Electrician:

"The insufficiency in existing methods is obvious. The subject under discussion in the board at the time this committee was appointed illustrates it. A prominent physician had displayed unusual public spirit as well as courage and devotion in danger. A member of the board, coming from the city where this physician resides, earnestly desired some adequate recognition for the public service thus rendered. There was no further degree in the medical profession that could be conferred, and nothing better could be suggested than to mark our appreciation of this physician's service by styling him a doctor of laws.

"Unnatural as this appears, there is the bad justification for it of the lack of any other degree within our gift, or that any of any other literary and educational institution, that would not seem more inappropriate. There is consequently a considerable accumulation of precedents for such use of the title of LL. D. Only a few weeks ago one of our large universities went further in this miscellaneous use of the degree—expressing its patriotic admiration of public service without seeming to perceive anything strange in its method of expression—by appending the title of LL. D. to that of admiral, already given by our government to the naval hero who sunk the Spanish ships in the harbor of Manila and added an archipelago to the domain of the United States. To some of us this is almost as incongruous as it would be to solve the embarrassment of Congress about the proper recognition for the gallant officer who saved another Spanish fleet from all temptation to run into danger by bottling it up, with a proposal to reward that humanitarian service with the title of doctor of divinity. If either use of these learned degrees is appropriate, what is there left for the leader who shall yet hoist the American flag over Santiago and Havana, excepting to make him a bishop?

"But it may be assumed that the board did not have in mind when appointing this committee such public service, naval or military, as has just been referred to. There exists admirable and ample degrees for cases of that kind—suitable, not incongruous—in the profession adorned, not in somebody else's profession, and fortunately a grateful country is not slow to bestow them.

"There are other services not so easily classified, and to the suitable recognition of which there is no such easy road. As a ready example (though by no means the most striking or characteristic), for the man who bound the Old World to the New by the Atlantic cable we had nothing but a public banquet and the conflagration of a city hall. About the only other available thing would have been to send him to Congress. The British premier of the day said that if he were a citizen to their country the government would have high honors for him. We had in the end, too, for Congress unanimously voted him its thanks and a gold medal. But such distinctions in the case of citizens not actually in the government service are so rare that they may almost be left out of reckoning. In the very field of electrical development, just referred to for illustration, what recognition has their own country given to Morse and to Edison? Other countries, in the case of each, were prompt and profuse, from France to Turkey. We have practically no ready and accepted method of publicly recognizing and properly distinguishing the wide range of voluntary service to the public, often most gallantly and devotedly rendered, by men in no way in the government employment. France has her Legion d'Honneur, as well as some other distinctions. England has perhaps a dozen, altogether, outside her orders of nobility. Most civilized governments have them. We do not, and it is not clear that they would be in accordance with the temper of our people or the genius of our institutions. At any rate, that is beyond our province as a board of regents.

"What is clear to your special committee is that the University of the State of New York has no authority to devise or confer other than educational or literary degrees; and that its duty is to bestow these or encourage their bestowal only for distinguished merit, and in cases where the degree is appropriate to the service it is intended to recognize. We may properly take note of the public need for some method for recognizing great and conspicuous service outside the fields either of government employment or of literary and educational activity; but we are constrained to express our sense of the incongruity of using our degrees for that purpose and of our lack of authority for addressing to the public recommendations on that or other subjects beyond those committed to our care."

Municipal Electricians' Convention.

The third annual convention of fire and police telegraph superintendents and municipal electricians will be held at Elmira, N. Y., on August 9th and 10th. Arrangements have been perfected for the entertainment of the ladies, and it is hoped that there will be a large attendance of the fair sex. All city officials are also invited to be present. Papers will be read by the following-named electricians: Captain William Brophy, chief electrician, Boston; S. L. Wheeler, city electrician, Springfield; John W. Aydon, superintendent fire and police telegraph, Wilmington; F. P. Foster, superintendent of fire telegraph, Corning, N. Y.; M. W. Mead, city electrician, Pittsburg, and others, to be followed by open discussion.

CORRESPONDENCE.

New York Notes.

New York, July 26.—There is a good deal of complaint nowadays because of the inconvenience and annoyance caused by the work of transforming the horse-car lines into underground trolley lines. It has been found necessary to close the lines temporarily upon which construction work is being pushed, but it is believed the new system will be in operation soon and that the public will be amply repaid.

The horse-car service of the Metropolitan Street Railway company on Sixth and Eighth avenues, south of Fifty-ninth street, has been discontinued to permit of the new electric-railway construction on those streets. Upper West Side patrons via Eighth, Columbus and Amsterdam avenues are carried over the electric line through Fifty-ninth street to and from transfer points at Seventh avenue, Madison avenue, Lexington avenue, and Second avenue. Until the Sixth and Eighth avenue lines are again in operation, extra facilities for the accommodation of the public, including east and west transfers, will be furnished on the Seventh and Ninth avenues horse-car lines. After October 1st there will be only two of the lines of railroad of the Metropolitan Street Railway company running up and down town operated by horse power. Since the difficulties caused by litigation were removed, several weeks ago, the company has been pushing the preparation of castings, etc., necessary for use in the construction of the electric lines on the routes of the Sixth and Eighth avenue railroads. There remain the digging of trenches, placing of the castings, the laying of the ties and rails and the stringing of wires. Contracts for this work have been let, and the work is now under way.

The State Railroad Commission has granted the application of the Nassau Electric Railroad company of Brooklyn for permission to cross the tracks of the Prospect Park and Coney Island road at Surf avenue, Coney Island, and that of the Brooklyn Heights company to cross the Ridgewood division of the Long Island railroad. Safety devices must be used in both cases. Decision was reserved on the Nassau company's application to increase its capital stock from $6,000,000 to $15,000,000.

The popularity of the trolley is attested in Brooklyn every evening, especially during the hot spell. The daily papers call attention to the fact that Brooklyn women take off their hats when riding on the open-trolley cars on warm days. This was first tried early in the season by several venturesome young women, and although frowned upon at first it is now quite popular, and it is not an unusual sight to see several hatless women riding in a car. It is a strange sight to see women returning from Coney Island and other resorts on the trolley over the bridge. When Park row is reached there is a great fuss among them smoothing back dishevelled hair and arranging headgear.

The New York and Philadelphia Traction company is operating cars between Somerville, N. J., and Bound Brook. This opens the first link of five miles of the proposed route from New York to Philadelphia. The construction of the road was begun in 1895, but the opposition of the New Jersey Central, the New Brunswick Traction company and the Bridgewater township officials kept the new company in litigation and delayed the construction. The Brunswick company was consolidated with the New York and Philadelphia company and all actions have been withdrawn from the courts.

Frank E. Mills last week obtained from Justice Bischoff, in the Supreme Court, an injunction restraining the Gold and Stock Telegraph company from removing the stock ticker of that company from his office, room 22, 40 Broadway. The New York Stock Exchange, under the contract by which it furnishes the Gold and Stock Telegraph company quotations, has the right of supervision over new subscribers, and has recently required the removal of a number of tickers from offices where the ownership had been changed. Officers of the Stock Exchange would not state whether action had been taken against the office of F. E. Mills, but it is reported that the Exchange authorities made inquiries looking to the taking of such action.

During the last month there have been several severe electrical storms, entailing loss of life and damage to property. Most of them have been in the East, along the Atlantic coast. The night of July 21st was marked by one of the most severe storms that has visited this section of the country. On that occasion lightning struck the wires leading into the depot of the Nassau Electric Railroad company at Ninth avenue and Twentieth street, Brooklyn, and set fire to the building. Several residences were also struck by lightning in Brooklyn.

The storm was one of the severest ever experienced on Staten Island, and considerable damage was done in a number of places. The trolley systems were crippled for a time. Lightning entered the power house of the Midland railroad, disabling one of the dynamos and blocking the road for an hour. The electric lights at Midland and South Beaches were extinguished and left those places in darkness. The large ferry house of the Rapid-transit railroad at St. George was thrown into total darkness by the burning out of the electric-light converter. Many telephone poles were shattered and wires were down in several places. H. I. C.

Canadian Intelligence.

Ottawa, July 23.—The Quebec electric railway has definitely passed into the possession of the Quebec, Montmorency and Charlevoix Railroad company. Colonel Strathy of Montreal, the representative of the new syndicate, paid the company which built the Quebec electric road $1,500,000.

The City Council of Hamilton, Ont., has decided to submit the following questions to the taxpayers: (1) Shall the city purchase and operate the Hamilton street railway? (2) If the city does not now purchase the Hamilton street railway, should the council extend the franchise of the company for 15 years?

The Rev. Father Paradis, of colonization fame in Northern Ontario, is in Montreal, and his energies are being directed to secure an electric tramway from Dunreny, two miles from Verner, to the waters of Lake Trinagain, a distance of 26 miles. This lake is surrounded by fertile land and its connection with the Canadian Pacific railroad is greatly to be desired. Father Paradis states that the water power is all that can be desired, and he hopes that, with a little aid from the Ontario government, the road can be completed in the near future.

Mr. C. O. Palmer, manager of the Sun Life Insurance company, at Kingston, Jamaica, is at present in Canada in this vicinity. He speaks highly of the project of harnessing the Rio Cobre by the West Indian Electric company, which is one of the largest schemes ever ventured in Jamaica. The works, which have already made considerable progress, are situated near the great tunnel at Boy Walk, at which point the river is 160 feet wide. The dam will stretch from one bank to the other, to be imbedded in the solid rock. In order to provide against all contingencies, the dam will be three times as strong as its estimated pressure. The foundations of the dam have already been built. The concrete and masonry sunk in the rock of the river bottom will go 10 feet below the water, and above the water the walls of the dam will rise some nine feet. The water is taken in from the dam by a pipe eight feet in diameter. The pipe will convey about 20,000 cubic feet of water, or about 120,000 gallons a minute, to the power works. It is provided with a steel valve to regulate and control the supply of water, and runs alongside the river for a mile and a quarter from the dam to the power house. The power house will be built entirely of steel and concrete, the steel work alone weighing 250,000 pounds. The river in its course for a mile and a quarter drops about 47 feet, which, added to the foot of the dam, amounts to 56 feet, which will be the fall of the pipe in its course to the works.

The Shawenegan Water and Power company, which has been incorporated to develop and utilize water power at Shawenegan, Que., will not manufacture pulp at present, as it has been determined to confine itself to the production of power. Among the incorporators of the company are John Joyce of Boston and David Russell of Montreal.

The first electric car traversed the streets of the city of St. Thomas, Ont., on July 15th. This electric street railway was begun on March 24th. The road is six miles long and it cost $80,000.

Hon. John Haggart of Perth, Ont., and others have incorporated the Canadian Electric and Water Power company, with a capital stock of $150,000, to produce and distribute electricity in Perth, as well as in other towns in the Dominion.

The Ottawa City Council has decided to submit the Sunday street-car question to the popular vote next January. There are two obstacles in the way of the operation of street cars on Sunday here. One is the prohibitive act of the Ontario Legislature and the other is a clause in the street-railway company's charter forbidding Sunday cars.

A new electric power company has been formed here. It will have a capital of $1,000,000. The promoter, Mr. Thomas Lindsay says: "The company has practically unlimited water power at its disposal. Of course, I cannot disclose the source of power at present, but we have 2,000 horse power to begin with, and can easily obtain 5,000 more whenever we need it. We intend to supply Ottawa with electricity for light, heat and power. In addition to water power we will have a steam auxiliary."

A. V. W.

Northwestern Notations.

Minneapolis, July 25.—The Burgess Electric company of Duluth, Minn., has made an estimate of cost for an electric car line 3,200 feet long for the Golden Star Mining company of the Seine river mining country.

The gasoline engine which furnished power for the electric-light plant in Benson, Minn., failed, and the town was in darkness until a deal was made with the Benson Mill company to take charge of the electric-light plant and furnish the power.

The Western Union has promoted Miss Stella Smith, manager of the Crookston, Minn., office, to a more lucrative position in the Fargo, N. D., office.

The Postal Telegraph company, which recently absorbed the Rocky Mountain Postal, will extend connecting lines east to the Canadian Pacific lines and south, it is understood.

Chester P. Wilson has resigned as general manager of the Sioux City Traction company of Sioux City, Iowa.

Lightning struck the wires of the Postal Telegraph company at Council Bluffs, Iowa, recently and cut off all connection with Sioux City. The latter place was unable to get Associated Press dispatches for a number of hours.

The Minneapolis General Electric company has procured a warrant for the arrest of Dr. A. E. Peck, a dentist, charging him with stealing electric power. Peck has a suite of four rooms and uses a good deal of electricity in lighting and for his instruments. The way the theft is alleged to have been committed was to solder a wire in the front room onto the wire leading to the meter in the rear room, and thus partially shunt all the front rooms from the meter. The soldering was done under a cleat which concealed the work. It is said that the doctor boasted of his success to his friends and knowledge of it finally came to the company. Suspicions had been entertained for some time, owing to the greatly reduced amount of light for which the doctor paid. When this news was received an investigation was made. The warrant is made under the law passed at the last legislature. The penalty is not to exceed a fine of $500 or five years' imprisonment.

The Greenman Electric company succeeds H. K. Greenman at Sioux City, Iowa.

Plans have been completed and bids are all in for an electric-light plant for St. John's University at St. Cloud, Minn. The cost is about $5,000.

The council committee at Duluth, Minn., has arranged to extinguish the arc lights in the outlying districts at 12 o'clock and has reduced the number of lights, thereby reducing the expense $30,000 per annum.

The village of St. James, Minn., contemplates putting in a new dynamo and another engine, to take care of the increasing business. The cost of the proposed improvements will be between $1,500 and $2,000.

The council of Neenah, Wis., has passed an ordinance requiring the electric street-car company to make two extensions of the line, and to use nothing but iron trolley poles in the city. The latter has been a point at issue between the council and the company ever since the line first reached Neenah. The company is disinclined to grant the council's demands.

James K. Tillotson, the successful promoter of the electric street-car system of Oshkosh, Wis., now has a larger scheme in view. It is to connect all the towns in the Fox River Valley by electric car lines. The plan includes Green Bay, Depere, Kaukauna, Neenah, Menasha, Oshkosh, Fond du Lac and the smaller villages west of Oshkosh. He is at present working for the proposed Oshkosh, Omro and Berlin line. The plan is to get a private right-of-way, instead of one along the highway, and to this end farmers are asked to contribute 15 feet next to the fence for the right-of-way. The progress is necessarily quite slow.

Mayor M. M. Shoetz of Menasha, Wis., sought to ride free on the street cars by virtue of his office. The conductor failed to see the matter in that light and demanded fare. On its being refused, he ejected his honor from the car. But the mayor felt that the dignity of the office was well worth a pass from the street-car company, and he had the conductor arrested for assault and battery. The city attorney appeared for the mayor and the company's attorney for the conductor. The case was continued for a few days. The mayor says he will fight to a finish, and the street-car company officials say that no one can ride free.

Twenty of the 50 men employed on the new interurban line being constructed between Eau Claire and Chippewa Falls, Wis., struck for a raise in their pay. To the men who remained at work the company offered a raise of 10 cents a day, and those who struck were not allowed to return, but others were readily secured in their places.

The Beloit Electric Light and Power company of Beloit, Wis., has purchased the old Rock River paper mill property, which includes a valuable water power. The building will be converted into an electric-light and power plant and many improvements made, at a total cost of $25,000.

Lightning struck the electric-light plant at Aberdeen, S. D., shortly before midnight recently, and the lightning arresters failed to work, resulting in burning out the dynamo. In five minutes the plant would have been shut down. The plant was crippled for a couple of days while repairs were made.

F. C. Duffy of Ripon, Wis., has been in Mitchell, S. D., in connection with the electric-light plant.

The station was recently burned, and an effort is being made to purchase the plant for the city. The company of which Mr. Duffy is a member is willing to sell, but its price is thought by the city officials to be rather high. Mr. Duffy says the company will rebuild the plant.

The mayor of Superior, Wis., has vetoed the contract with the Light and Power company for furnishing the city light for five years at $100 per arc light per annum. He thinks that $90 is enough and opposes a longer contract than three years. The council sustained the veto. The council at once ordered all lights out, and the company complied, with the exception of 25, for which it claims a contract at $126 a light until 1904. M. S. P.

PERSONAL.

Herbert A. Wagner of St. Louis spent several days in Chicago recently.

H. J. Medbery of Mechanicville, N. Y., has been enjoying a western trip during the last month. He was in Chicago on Monday.

D. E. Goe, well known among the electrical fraternity of the West, has accepted a position with the Sprague Electric company, and will have charge of the advertising department. Mr. Goe has made a specialty for years of designing unique advertisements, and his work in this direction has been very effective.

ELECTRIC LIGHTING.

F. W. Luce, George McCoid and Carroll Bolter have bought up all the stock in the electric-light company at Logan, Ia., and will try to place the plant on a paying basis.

The Los Angeles (Cal.) Times of recent date reports that the San Bernardino Gas company's plant has passed into the hands of C. R. Lloyd, the price being $20,000. The electric light and gas plants are now owned by one corporation. It is rumored that the local company has been absorbed by the Southern California Power company, and if this be true, that corporation will, it is stated, have full control of every electric plant and all water power between Redlands and Los Angeles.

A San Francisco paper states that the Fort Wayne Electric corporation and the Tuthill Waterwheel company have shipped the first electric-lighting and power apparatus ever sent from that city to South America. It is for the Yanni Development company, which is controlled by the Rothschilds' syndicate in London. Heretofore all mining equipments have been sent there from London and Germany. The machinery will be landed in Peru and sent overland 600 miles to the mines in the Andes beyond Lake Titicaca.

The "Bulletin des Usines Electriques," in an article discussing the question of extending the time of the concession for lighting Paris, gives a few interesting details about electric lighting in Berlin. There are some 300,000 incandescent lamps of 16 candle power installed in the German capital, beside several thousand arc lamps. The length of mains is about 186 miles, and the power developed is about 28,000 horse power. There are also some 1,600 motors, taking 6,450 horse power. The price for lighting is 15 cents a kilowatt-hour; for power it is four cents a kilowatt-hour. Paris consumes some 25,000 horse power for about 418,000 lamps of 10 candles and 7,448 arc lamps, with about 240 miles of mains. The motors number 513, requiring 1,940 horse power, and the price is 23 cents per kilowatt-hour.

ELECTRIC RAILWAYS.

The Chicago and Fox Lake Electric Railroad company was incorporated on July 18th, the men interested being John W. Greene, Charles E. Soule, Jr., William A. Kawson, Stewart Spalding, Frank N. Willis and F. W. Pringle, all of Chicago. There is a capital stock of $20,000, and the line will begin in Lake county and run through McHenry county to the Wisconsin state line.

The building of an electric railway to connect Redlands and San Bernardino, Cal., is under consideration. It is proposed to start at the corner of State and Orange streets in Redlands, running north on Orange to the Baseline; thence west on the Baseline to D street in San Bernardino; thence south on D street to Third street; thence west on Third street to the Santa Fe railway station. James H. Boyd of San Bernardino is interested in the project.

Judge O'Rourke has rendered his decision in the Fort Wayne street-railway case. A special dispatch to the Chicago Record says that the court finds that John J. Shipherd wrongfully used more than $500,000 worth of bonds, and it adds that "the decision says that the Cleveland capitalists were aware of Shipherd's peculations when they purchased bonds of him, and orders these capitalists to turn back as assets to the company $990,000 worth of bonds, thus protecting small creditors and bondholders. Motion for new trial was made. The road is now in the hands of a receiver."

The English Iron and Coal Trades Review states that a commencement has been made with the work of laying the rails for the experimental electric railway line from St. George's Church, Castle street, to the Dingle, Liverpool. Much delay has been caused with the work, chiefly owing to the difficulty experienced in getting delivery of the rails. About 50 tons of American rails have been received, besides a quantity from an English firm. Operations were commenced in Park lane, and the work will be pushed on rapidly. Owing to the depth of the American rails, it is stated that a portion of the concrete foundation of the roadway will have to be disturbed. The overhead electric trolley system will be used on this experimental line.

There are at present 64 German towns provided with electric-traction systems, as compared with 44 a year ago. Besides this, 26 towns have electric railways in course of construction and 30 more have extensions in hand. Reckoned up to September 1, 1897, the total length of the lines was 594 miles, as compared with 364 miles on August 1, 1896, these figures representing 843 and 533 miles of track, respectively. The number of motor cars running was 2,255 in 1897, as compared with 1,571 in 1896, and the capacity of the railway generators in use is estimated at 24,920 kilowatts, as compared with 18,560 of the previous year. It is interesting to compare the figure 24,920 kilowatts with the plant capacity of the German electric-lighting stations, which amounted to 67,340 kilowatts, exclusive of accumulators, on March 1, 1897.

The Buffalo, Tonawanda and Niagara Falls Electric Railroad company on Saturday, July 16th, opened for traffic a new extension of its lines. This new line begins at the corner of Tonawanda and O'Neil streets on the northerly limits of the city of Buffalo, and follows O'Neil street to Niagara street, thence along Niagara street about one mile to a ferry on Niagara River, which runs between the terminal of this new extension and various resorts on Grand Island. This line will be farther extended along Niagara street to the village of Tonawanda, and is expected to be the most popular electric line between Buffalo and Niagara Falls, as it follows the high banks of the Niagara River the entire distance in full view of the beautiful scenery of that river and Grand Island. Henry B. Smith of Bay City, Mich., is the principal stockholder.

TELEPHONE.

The Central Union Telephone company secured a franchise at La Porte, Ind., but the city council now wants to withdraw the franchise.

The South Missouri Telephone company of Pierce City, Mo., has been incorporated with a capital stock of $20,000. The incorporators are A. J. Armstrong, G. R. Armstrong, Albert Newman and others.

The Freehold Telegraph and Telephone company has been organized at Trenton, N. J., with a capital stock of $10,000. The incorporators are F. L. Benson and R. E. Emory of Jersey City, and S. A. Boyd of Brooklyn.

The Hamlin-Huntington Telephone company of Hamlin, West Virginia, will erect and maintain telephone lines at Hamlin, Lincoln county, and elsewhere. The incorporators are R. R. Wilson, C. W. May, R. Sweetland, J. D. Porter, B. B. Curry, I. S. Sweetland, W. W. Baker of Hamlin and J. A. Holly of Charleston.

The Eastman Electric Light and Telephone company of Eastman, Ga., has been granted a telephone franchise and will begin work at once, and hopes to have an exchange completed in 60 days. The officers of the company are W. N. Lietch, president; W. M. Clements, vice-president; J. B. Caldwell, secretary and treasurer; James Harrison, superintendent.

The Brenham and Shelby Telephone company has been formed to construct and maintain a telephone line from Brenham to Shelby, Austin county, Texas, and other telephone lines in Washington, Austin and other counties in the state. The incorporators are W. C. Henderson of Brenham, E. C. Lass of Shelby, D. C. Giddings, Jr., of Brenham, and E. H. Eversberg of Brenham.

POWER TRANSMISSION.

The Welland Power and Canal Supply company still has some hope that it will be able to carry its project through to completion. This company holds a franchise for the construction of a power canal from the Welland river to the brow of the mountain at Thorold, Ont., a distance of about eight miles. From the mountain it would carry the water to Lake Ontario by means of a raceway, possibly using the water at another level. Henry Symons has just returned from England, where he went to see what could be done with the project and to secure estimates on its probable cost. The estimates Mr. Symons has given out were prepared by Dr. Hopkinson, Edmund Wragge, Sir Douglass Fox and Prof. W. Cawthorne Unwin. In the estimates given it is stated that the machinery to generate 100,000 horse power will cost £125,000; the excavation and other work connected with the project, £1,525,062; the transmission line to Toronto, at a voltage of 10,000 and delivery of 50,000 horse power, £801,600, making a total of £2,452,162, which is in the neighborhood of $12,000,000. If the amount to be delivered in Toronto is reduced to 20,000 horse power it would cost $1,000,000 less.

ELECTRICAL SECURITIES.

The Union Traction company of Philadelphia during the year ended June 30th earned $10,971,437, an increase of $49,791, or about 4.6 per cent. over the preceding year. Expenses were reduced $493,475, the total expenditure being $4,456,375. The net earnings were $6,515,062, and after taxes and charges of $6,490,441 have been deducted, there remains a surplus of $24,620. The directors report that the gross receipts for 17 days of July showed a considerable increase over the same days last year.

An order granted by Judge Nash on July 18th brings to an end the case of the Rochester Railway company against the assessors of that city to cancel an assessment upon the capital stock of the company for 1897. The order is based on the report of Referee S. D. Bentley. The stock was assessed at $800,000 and the company objected, claiming that the entire assessment should be stricken off. The assessors reduced the amount to $700,000, but, as the reduction was unsatisfactory, the action was commenced. The referee found that the value of all property, exclusive of franchises, was $1,682,097.67; that the value of all assessable shares of other corporations held by the company was $208,800; that the assessed valuation of the company's real estate was $659,125; that the company's indebtedness was $4,751,198.54; that the market value of the shares of stock did not exceed $1,000,000, and that the actual value of the stock was nothing. The conclusions of law are that the assessment upon the capital stock was excessive and erroneous and the company is granted the relief asked for. Both the city and county are to strike the assessments from their books, and if any portion has been paid it is to be refunded with interest. There is a similar action in the courts in regard to the assessment of 1898, but in view of the decision it will be settled by the city.

TRADE NEWS.

The Western Electric company has purchased from Joseph Downey and wife the ground and five-story building on Jefferson street, just south of Van Buren street, for $122,500. The purchase has a frontage of 99 feet and a depth of 159 feet. It was secured for the extension of the company's factories, which seems to be constantly going on.

James S. Healey of the Julius Andrae & Sons company, Milwaukee, has just returned from a trip through southern Wisconsin in the interest of Andrae telephones and electrical supplies. Mr. Healey reports trade exceptionally good in that section of the Northwest. The same company is the Milwaukee selling agent for the Lundell fan motors. It has succeeded in placing the Sprague goods in many of the largest local business houses, hotels and theaters, including the Alhambra Theater, Palm Garden and Kroeger Bros'. large clothing establishment.

The John A. Roebling's Sons company of Trenton, New York, Chicago and San Francisco has issued a handsome souvenir catalogue in commemoration of the fiftieth aniversary of the establishment of the works at Trenton, N. J., by Mr. John A. Roebling. There is a portrait of the original Roebling and pictures showing the development of the works during the half-century. The main body of the catalogue refers principally to wire rope and electrical wires. The tables have been thoroughly revised and brought up to date. They represent a great deal of labor, and are thought to offer the best information obtainable to-day on the subject of wire rope and electrical wires, from the standpoint of the consumer.

The Electrical Engineer Institute of Correspondence Instruction of 120 Liberty street, New York, reports a gratifying success. "Since the organization of this institute in the early part of the present year," says the manager, "every state and territory of our country, as well as many foreign countries, has furnished its quota of students, who have hailed with many a kind word of appreciation the advent of the system which is rapidly proving to be almost ideal in its treatment of engineering subjects, and particularly those involving the manifold applications of electricity. No doubt much of this success must be attributed to the standard set by the institue, which, we feel safe in saying, cannot be surpassed, since such eminent authorities as Professor Francis B. Crocker, of Columbia University; Charles F. Scott, the chief electrician of the Westinghouse Electric and Manufacturing company; Elmer G. Willyoung, the well-known electrical instrument expert; William Maver, Jr., the celebrated authority on telegraphy; Thorburn Reid, the well-known designer of electrical machinery, and many others are included among those who have prepared papers for the courses of the institute." An interesting book of information, "Can I Become an Electrical Engineer?" is sent free on request.

BUSINESS.

Huebel & Manger of Brooklyn are working on a new catalogue which they hope to issue shortly. The book will list all of their well-known articles as

well as some new ones. The firm is keeping the quality of its goods up to a high standard and keeping up to date with its prices.

The Hope Electric Appliance company of Providence is manufacturing a line of safety knife switches which it claims is equal to any on the market.

The Central Electric company of Chicago reports a brisk trade in lightning arresters. It is issuing an atractive circular on the Wurts arrester and the Garton arrester.

The Fort Wayne Lamp company of Cleveland has issued a leaflet rejoicing at the favorable war outlook, and incidentally calling attention to the merits of its tipless lamps.

The Carolina Light and Power company, Aiken, S. C., has recently ordered a 250 horse power cross-compound engine from the Ball Engine company, Erie, Pa. The engine is supplementary to the present power plant. The city of Elkhorn, Wis., has also recently ordered a 135 horse power compound condensing Ball engine for its electric plant.

The Electric Appliance company is very proud of the fact that it will soon complete the seventh year of its electrical supply business. The Electric Appliance company claims that after confining itself strictly to the electrical supply business, as it has done, for this period of time, it should be in the best possible position to handle that branch of the electrical business successfully. It is very apparent from the volume of business it is now doing and its position in the electrical field that its business has been thus far very successfully handled.

The Storey Motor and Tool company has moved its main office and factory from Philadelphia to 464 South Broad street, Trenton, N. J., in the plant with the Trenton Iron company, this change having been made necessary by the greatly increased demands for the company's machinery. The motors at present manufactured by the company have been improved both mechanically and electrically. With increased facilities the company will also introduce open-type machines for all classes of standard work, together with several lines of specialties which, up to the present time, it has been unable to put upon the market.

The American Impulse Wheel company of New York announces that it is making steady headway with its improved water wheel, and that it is attracting considerable attention in this and foreign countries. Besides wheels shipped to points in the United States, the company has wheels installed in Japan, France, Sweden and Scotland. Among contemplated large power and transmission plants in Utah, Canada, Montana and Minnesota, this company's wheels are receiving serious consideration. The Columbus, Ohio, plant which this company is building will be a novel one. The company will spare no pains to perfect mechanical design and construction, and secure the highest efficiency. Mr. Thornburn Reid is consulting engineer of the company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

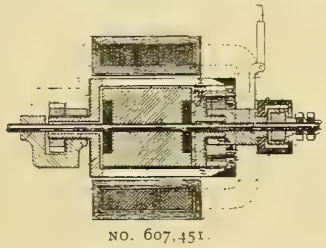
Issued July 19, 1898

607,451. Electro-magetic Motor. Archie B. McMillan, New York, N. Y. Application filed July 7, 1897.

The combination is described with a motor having an armature and field magnet, of a secondary armature acted upon inductively by a rotating field of force produced by the rotating element of the motor.

607,476. Weighing Machine. Francis H. Richards, Hartford, Conn. Application filed October 11, 1897.

An electric circuit controls a valve opening and closing actuator, while weighing means are provided embodying a relatively movable poising device and a circuit controller is carried directly by the poising device.



NO. 607,451.

607,540. Electrical Resistance. Harvey S. Chase, Boston, Mass. Application filed January 11, 1897.

Upon a base or support of heat conductive material there are arranged a plurality of separated resistance elements in electrical series, each complete in itself, and attachable independently to and in heat-conductive contact with the base or support, each of the elements being incased in an envelope of insulating material, the envelope of each element being independent of those of the others.

607,551. Electric Regulator. Joseph A. Powers, Lansington, N. Y. Application filed October 28, 1897. Renewed June 17, 1898.

A regulator for electric railway system comprises a fluid resistance and separable plates therein, one of the plates being connected to earth and the other to the line, of a solenoid and core for varying the distance between the plates, the solenoid being included in the circuit from the generator and adapted to exert a pull or attractive force upon the core equal, with a given current, in all positions of the core.

607,589. Electric-arc Lamp. John H. J. Haines, New York, N. Y. Application filed October 29, 1896. Renewed May 12, 1898.

A clutch for an arc lamp consisting of a tilting ring formed of two united plates, each provided with an undercut groove on its inner periphery, and a series of balls confined in the raceway formed by the grooves, is a feature of the invention.

607,590. Galvanic Cell. Albrecht Heil, Fränkisch Crumbach, Germany. Application filed December 1, 1897.

A galvanic cell comprising a carbon electrode surrounded in about equal parts by volume of graphite, manganese peroxide and lead peroxide, a zinc electrode and an absorbent filling holding an electrolyte of zinc sulphate containing flocks of hydrate of zinc evenly distributed throughout the mass of the electrolyte.

607,593. Dynamo-electric Machine. William B. Sayers, Glasgow, Scotland. Application filed December 21, 1897. Patented in England November 30, 1896.

A dynamo-electric machine having an armature in which the sections of the armature winding are connected to the commutator sections by commutator coils, and a field magnet each pole of which is provided with an independent pair of reversing pole-pieces arranged at opposite sides of separate from the field-magnet pole, each pair of pole-pieces being magnetically connected together and arranged in proximity to the armature core so as to form a magnetic circuit therewith.

607,608. Rheostat. Michael J. Shiels, Westfield, N. J. Application filed January 7, 1898.

Part of the casing consists of a plate or body of insulating material and the remainder of heat-conducting material. Switch contacts are mounted on the plate. Terminal connections are established from the coils to the contacts with insulating cement within the casing embedding the coils and extending between the coils and the casing. A movable contact arm and connections complete the arrangement.

607,609. Field Magnet for Electric Machines. Sidney H. Short, Cleveland, Ohio. Application filed May 4, 1896.

Cores or supports for the field-magnet windings, each comprising a series of plates or laminations, whereby the continuity of the end surface of such cores is broken, in combination with a ring of magnetic material arranged to surround the armature end of each of the cores or supports.

607,610. Electric-railway System. Sidney H. Short, Cleveland, Ohio. Application filed May 24, 1897.

A normally open main supply circuit extending throughout the length of the road, a normally open auxiliary circuit also extending throughout the length of the road, a series of contacts arranged in the roadbed, adjacent contacts of the series being respectively connected to the positive and negative wires of the auxiliary circuit, an electromagnet arranged in each of the auxiliary-circuit connections, means carried by the car for bridging the space between adjacent contacts of the series, and means actuated by the energization of the electromagnets for closing the main supply circuit through the motor on the car.

607,611. Electric-railway System. Sidney H. Short, Cleveland, Ohio. Application filed July 9, 1897.

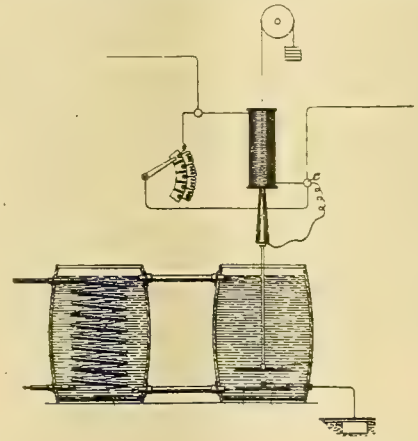
A box or casing is arranged in the roadbed and has an opening in the top with a surface contact of smaller size than the opening, arranged to project through it in combination with a circuit for the contact, and means carried by the car for completing the circuit through the contact.

607,617. Regulating Switch for Electric Circuits. Harry P. Davis, Pittsburg, and Gilbert Wright, Wilkinsburg, Pa. Application filed September 18, 1897.

Essential features include two-sets of annularly arranged stationary contacts, a pivoted co-operating contact arm for each set of stationary contacts, a single pivoted operating lever having a limited reciprocatory movement and means intermediate the lever and each contact arm whereby the arms may be oppositely moved from one stationary contact to the next through the entire set in either direction.

607,621. System of Electrical Distribution. Benjamin G. Lamme, Pittsburg, Pa. Original application filed January 28, 1897. Divided and this application filed December 16, 1897.

The method of supplying a three wire direct-current system of distribution with energy from an alternating current transformer consists in transforming the alternating current into direct current for the main direct-current conductors and transferring energy to and from the middle point of the secondary of the alternating-current transformer.



NO. 607,551.

607,638. Electric Line Switch. Antoine B. du Pont, Detroit, Mich. Application filed August 12, 1897.

A switch for electric conductors comprising the combination of a tongue, ribbed sections at each end of the tongue insulated from the main conductor, a string for holding the tongue in one of its operative positions, a solenoid coil having its terminals connected respectively to the main conductor and to the ribbed sections, and an armature connected to the tongue and actuated by the current in the coil.

607,646. Electrolytic Bath. Pascal Marino, Paris, France. Application filed December 1, 1896. Patented in Belgium June 15, 1896.

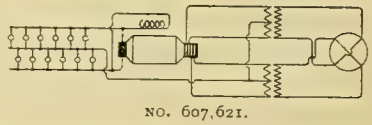
The process of electrolytic production of metals consists in adding to a solution of a salt of the metal to be deposited alkali-metal salts of the same acid and an alkali-earth-metal salt of another acid in such quantity as to give, by an incomplete double decomposition, an insoluble precipitate and a mixed solution of different soluble salts of the metal to be deposited, and electrolyzing such mixed solution.

607,672. Controller. Thorsten von Zweigbergk, Cleveland, Ohio. Application filed April 8, 1898.

A suitably protected solenoid coil for a controller blow-out consisting of a spirally wound ribbon of metal interposed insulating material, two recessed plates embracing the coil, plates of mica or similar material on each side of the coil, pins connecting the two plates together.

607,697. Electric Railroad. Clarence A. Myers, Atlantic City, N. J. Application filed November 18, 1897.

A track rail, comprising two sections spaced apart and forming opposite walls of a conduit, the tread of one section being below the plane of the other section tread, an insulating material arranged in a groove in the underside of a section tread, and a conductor for electricity supported by the insulating materal.



NO. 607,621.

607,714. Electric Stop-motion for Looms. Alejandro Stephens, Guadalajara, Mexico. Application filed June 26, 1897.

In an electric stop-motion for looms there is the combination with a shuttle and contact plates therein, of an eyeplate in the shuttle and having a segmental offset on its rear face, and a loose disk forming a circuit breaker, and provided with a central aperture through which the shuttle thread passes to support the disk.

607,715. Voltmeter. John F. Stevens, Philadelphia, Pa. Application filed April 22, 1897. Renewed May 4, 1898.

A resistance coil is connected in shunt across the terminals of the working coil and is provided with a core and casing of iron which forms a magnetic circuit, the amount of iron being sufficient not to be saturated by the current passing through the instrument.

607,737. Dynamo-electric Machine. Adolf G. Eigner, St. Petersburg, Russia. Application filed May 7, 1898.

A field magnet for dynamo-electric machines is formed of separate complemental members joined together, each of said members having projections co-operating with the projections of another member to form complete polar projections, the members being separated to form slots in said polar projections.

607,745. Electric Buoy. Ernst W. G. C. Hoffmann, Charlottenburg, Germany. Filed May 28, 1896. Patented in Germany February 12, 1896.

In a device of the class described adapted to be floated and submerged there is the combination with a pump designed to secure the entrance and exit of the water serving as variable ballast in the device, the pump having a relatively large clearance, whereby the rarefaction of air in the device is avoided, of means for actuating the pump controllable from without the device.

607,746. Bond for Electric Conductors. Slaughter W. Huff, Baltimore, Md. Application filed August 29, 1896.

A bond for making electrical connections is formed of flat metal and comprising a body portion and an integral external extension bent about an axis transverse to the body portion into a tubular attaching lug projecting laterally from the flat body portion.

607,760. Circuit Arrangement for Electrical Apparatus. Julius Miesler, Vienna, Austria-Hungary. Application filed December 13, 1897. Patented in Germany March 21, 1896; in Switzerland March 30, 1896; in Italy May 22, 1896, and in Austria September 18, 1896.

The circuit arrangement described consists of the association with common mains or conductors of a plurality of individual or separate circuits in parallel relation therewith, each of the circuits being provided with a source or supply of electrical energy, a translating device, and a switch device disposed in the circuit and adapted to short-circuit the electrical apparatus connected between the mains when the device is closed.

607,801. Long-distance Telephone. Paul de Kilduchevcky, London, England. Application filed February 10, 1897.

In a telephone transmitter there is the combination of a plurality of microphones, each formed of carbon pencils in parallel bound together so as to vibrate in unison and hermetically sealed within an exhausted bulb mounted on the diaphragm of the transmitter, the microphones being connected in parallel with as many batteries and with the primary windings of an induction coil comprising as many parallel primary windings as there are microphones.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, AUGUST 6, 1898. No. 6

Features of a Philadelphia Office-building Plant.

An interesting electric-light and power plant has just been installed in the Land, Title and Trust building at Chestnut and Broad streets, Philadelphia, by the Chicago Edison company. The building is the tallest commercial structure in Philadelphia, and is situated within one block of the city hall. The plant has some unique features which, to a certain extent, distinguish it from plants heretofore installed in modern office buildings.

The light and power machinery installation consists of two Westinghouse compound automatic engines, with cylinders 11 by 19 inches in diameter and 11 inches stroke, direct-connected by means of the Arnold quill-drive system to two 45 kilowatt Siemens & Halske generators. By this arrangement either engine can run either one or both dynamos, a liberal reserve capacity having been allowed for the engines. The arrangement of dynamos and engines is shown in Fig. 1.

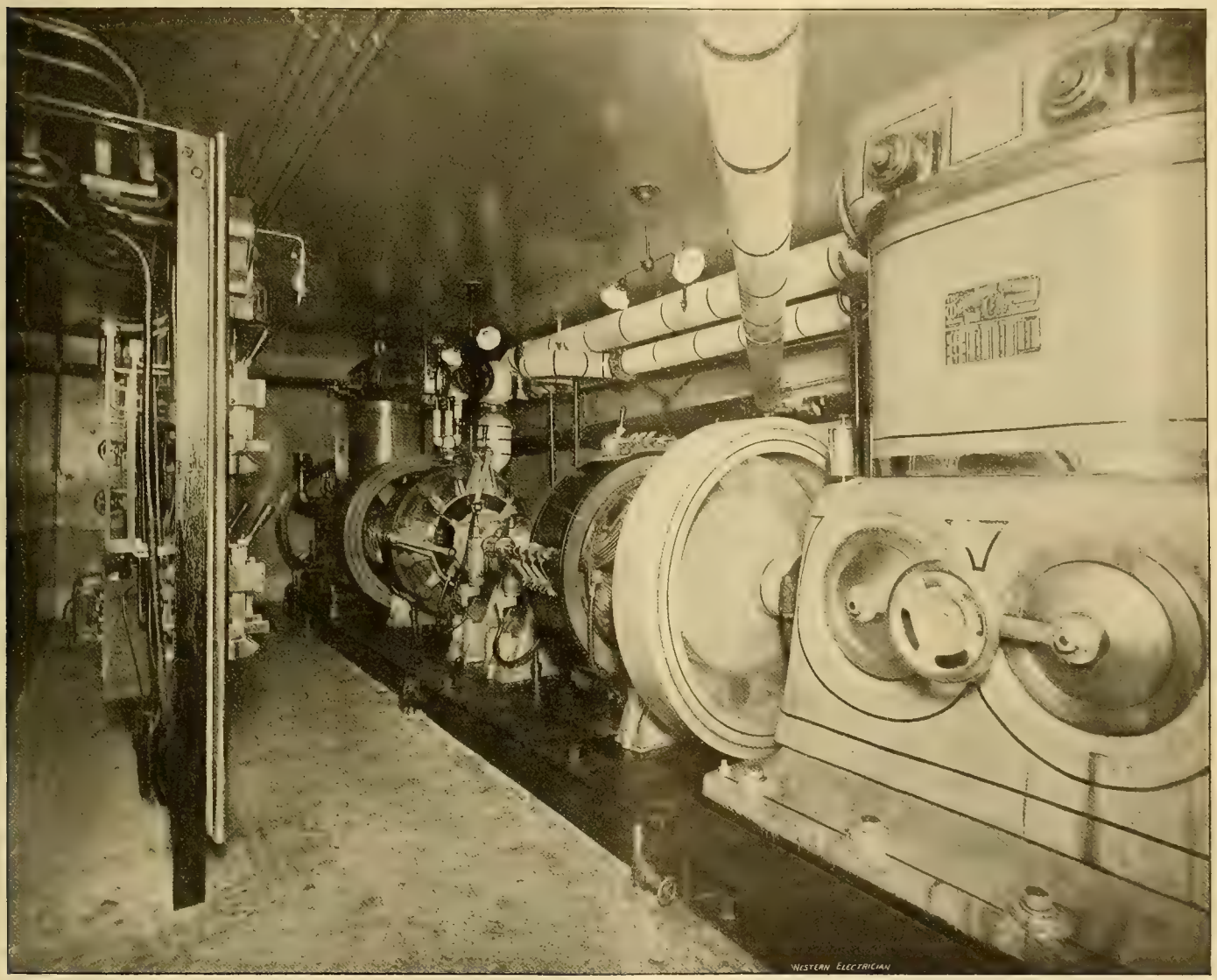


FIG 1. FEATURES OF A PHILADELPHIA OFFICE BUILDING PLANT. ENGINES AND DYNAMOS.

To further guard against any possibility of a breakdown, a storage-battery plant is provided consisting of 65 cells of the standard "15 F" type, manufactured by the Electric Storage Battery company. In addition to acting as a reserve, the battery answers the double purpose of providing economically the current for the night load when the dynamos are shut down and also of acting as a pressure equalizer during the daytime under sudden fluctuations of load.

An examination of the wiring diagram on the next page (Fig. 2) will show that the battery is so connected that the circuit for charging is independent of the discharging circuit, the 50-ampere end-cell switch being used for the charging circuit, and the 400-ampere end-cell switch for the discharging circuit.

Fig. 3 represents the switchboard, which is built of white Italian marble on an iron framework, with a neat metal border.

All feeders are provided with automatic Cutter circuit-breaker switches and are connected through a multiple-point switch with Weston illuminated dial ammeters. The instruments and switches are finished in nickel.

The building is wired for 3,000 16 candle power lamps and 125 horse power in motors, with 10 sets of feeders controlled by independent switches at the switchboard. All wires are run in iron-armored conduit. Special cast-iron outlet boxes are provided at all light and switch outlets. On each floor is a cast-iron cut-out cabinet 20 by 50 inches, lined with white Italian marble. The ends of the conduit are tapped into the cabinet by thread connections, and the wires in the cabinets are brought directly to the cut-outs without any crossing of opposite polarities.

The first and second floors of the building are occupied by the Land, Title and Trust company for banking purposes, with a large deposit vault in the basement. The upper floors of the building are rented for offices. The different departments of the bank and safe-deposit vaults are connected by a complete telephone and annunciator-call system, all the wiring of which, as well as the watchman's clock system, is installed in iron-armored conduit.

The specifications for this complete plant were drawn by Mr. C. W. Wilkes of D. H. Burnham & Co., Chicago, architects of the building, and the work was installed under the supervision of Messrs. J. H. Goehst and S. M. Bushnell of the Chicago Edison company. A group of the Chicago electricians engaged on the work is shown on page 73.

Litigation Over Aluminum Patents.

The taking of evidence in the lawsuit of the Cowles Electric Smelting and Aluminum company against the Pittsburg Reduction company, which has been in progress at Niagara Falls for several weeks, has finally been completed. The suit is one of several growing out of aluminum patents, and alleges infringement of the Bradley patents which relate to electric smelting or fusing of ores and decomposing metals from them.

In 1891 the Cowles company brought suit against the Pittsburg Reduction company, claiming it was then infringing the Cowles electric smelting patents. Before the testimony in the case was presented there were issued from the United States Patent Office three patents to Charles S. Bradley. These patents were largely of the same nature as the Cowles patents and had been pending in the Patent Office ever since February, 1883. They therefore bore an earlier date of application than did the Cowles patents, and their issuance furnished a defense by anticipation of the Cowles company patents, which the Pittsburg Reduction company could set up. Knowing this, the Cowles company, it is

said, voluntarily withdrew the suit against the Pittsburg Reduction company in 1891.

The patents issued by the United States Patent Office to Charles S. Bradley were assigned by him, it seems, to Grosvenor P. Lowery, who was then the American representative of the aluminum company doing business at the Falls of the Rhine, Switzerland. Upon the issuance of the patents to Lowery, he at once notified the Cowles company and the Pittsburg Reduction company that they were infringing the patents. But the Cowles brothers had encountered Bradley in the Patent Office in 1885 while their patents were pending, and had bought from him all of his inventions relative to electric smelting processes or furnaces. Hence the second assignment led to a legal dispute, which was settled only after four years of litigation, the decision being in favor of the Cowles company. It then commenced the present suit against the Pittsburg Reduction company. However, while this was going on the Pittsburg Reduction company commenced suit against the Cowles company, alleging an infringement of the patents granted to Charles M. Hall. This suit was decided in favor of the Pittsburg Reduction company by the lower courts and the Hall patent was construed by the court so broadly as to prevent the Cowles company from manufacturing pure aluminum, and for this reason the Cowles plant in Lockport has been practically idle since the decision. Judge Taft, who gave the decision, passed the case into the hands of a master to assess damages against the Cowles company. The finding of this master are now completed and the case will soon be appealed to a higher court.

During the taking of evidence at Niagara Falls there were several very prominent witnesses for the Pittsburg Reduction company, including Professor Thurston of Cornell University and Professor Chandler and Professor Laroux of Columbia. The Cowles company was represented at the hearing by Alfred H. Cowles and E. N. Dickinson.

American Street Railway Association.

On August 1st T. C. Penington, secretary of American Street Railway association, issued a circular to remind members that the next meeting of the association would be held at Mechanics' Association Hall, Huntington avenue, Boston, on September 6th, 7th, 8th and 9th. "We expect to have the largest convention we have ever held," he says, and adds that papers will be read on live subjects, and that the exhibits will be a prominent feature of the meeting. In order to secure reduced fare delegates must get a certificate from the agent when they purchase railroad tickets. The association headquarters will be at Hotel Brunswick.

The Wabash railroad will run special cars on the Continental limited, for the benefit of western members. This train will leave Chicago at noon on bers. This train will leave Chicago at noon on Sunday afternoon at 5:50 o'clock. Special arrangements will be made for ladies accompanying delegates.

General Distribution from Central Stations by Alternating Currents.[1]

By Herbert A. Wagner.

Ever since the installation of the first few pioneer alternating-current central station, just 10 years ago, we have heard it predicted with persistent reiteration that for the distribution of current for lighting from central stations direct current was a thing of the past, and that in a few years the alternating-current transformer system would hold the field without a competitor.

To many this prediction may seem to have been fulfilled, considering the enormous number of alternating-current plants, compared with direct-current, that have been installed, and the remarkable impetus given to electrical industries by the development of alternating currents. The great success achieved in the transmission of power by polyphase alternating currents in the last three years has strengthened this general belief, and left fewer champions to adhere to the direct-current cause. These great achievements, I say, have led the enthusiast to think all progress confined to alternating systems of distribution. Deeper investigation, however, shows that while in point of number the alternating-current stations, reaching into the thousands, completely overshadow those of direct-current, there are few really large stations, outside of water-power plants, that are to-day employing alternating currents for distribution, and that while enormous investments have been made in direct-current stations in our larger cities, comparatively small amounts have been invested in alternating-current work.

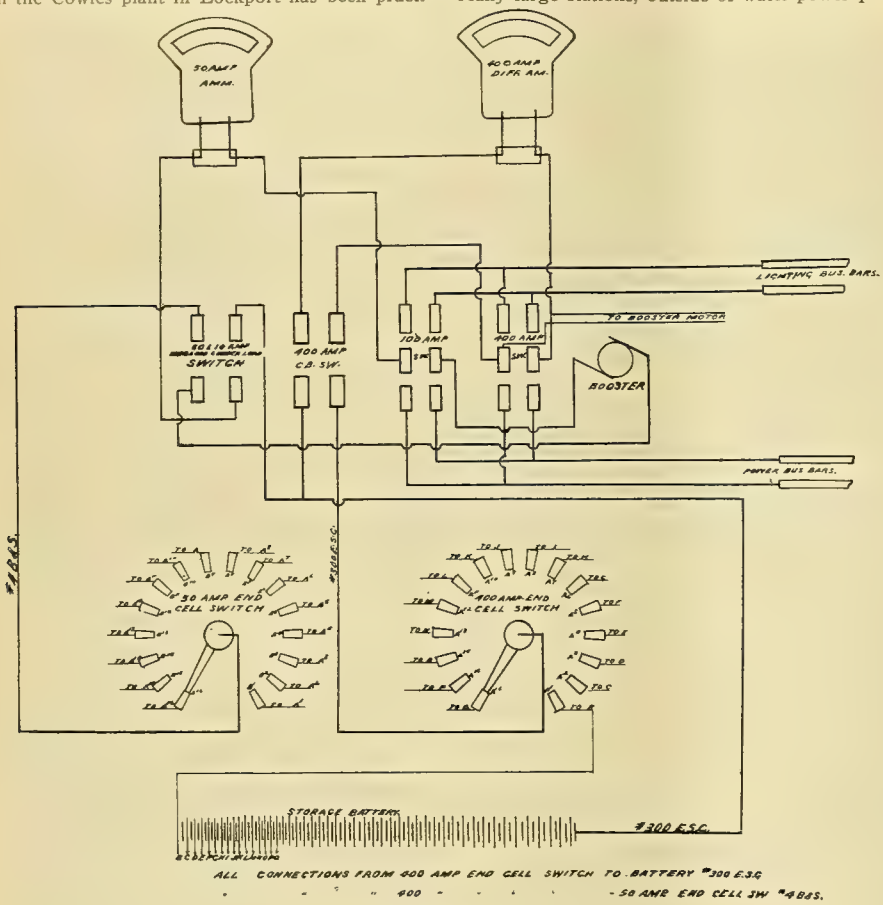


FIG. 2. FEATURES OF A PHILADELPHIA OFFICE-BUILDING PLANT — WIRING DIAGRAM OF BATTERY PANEL ON SWITCHBOARD.

The alternating system was heralded as providing a means of distribution with a great reduction in first cost of plant, and for years the development of the system has been made with this principal end in view. On the other hand, direct-current distribution in the form of the Edison three-wire system has been steadily and intelligently developed to the highest standard of economy of operation, simplicity and permanence. In the same city alternating-current stations have not, as a rule, been successful in competition with three-wire stations, their serivce has not been as good and their profits have been smaller.

I may startle many by stating frankly the discouraging fact, which has been barely whispered at times, that, judged by the standards of the magnificent Edison properties in many of our larger cities, few alternating-current central stations in the United States have been a success. Do not imagine that this damaging admission, however, is an indication of any loss of faith on the part of one who has been identified with alternating-current work since its debut, as it were. Far from it. The fault lies, not with the alternating current itself, but with its application. Its few apparently inherent deficiencies, such as the difficulties of operating motors and arc lamps, have been shown to have been only awaiting discovery and development. They were at our disposal almost as soon as these important divisions of central-station service were operated with success from the Edison three-wire system. These can, therefore, hardly be held responsible for the difference in the commercial results obtained with the two systems.

As I have said, the ends in view in the development of the two systems have been radically different. The one was to product a given amount of light for the minimum of investment; the other was to provide a permanent investment that would render the maximum of profit. These standpoints in general mark the difference between the manufacturer and the user, and we find these two systems developed in this way—one almost entirely by the manufacturer, and the other by the combined efforts of the various users. The results are the natural effects of progression along these lines.

Few opportunities have we had of comparing the two systems from the same standpoint and under like conditions. The purpose of this paper is to show the alternating current applied from the same standpoint, compelled to fulfill the same conditions and then to compare the results with the best produced with direct current.

To contrast the different methods of distribution better we will review briefly those in general use before describing the most recent developments.

The early alternating-current stations were installed on the principle that the drop in lines with distribution at 1,000 volts was so small that it was practically negligible. Two wires were accordingly run out from the station, passing along those streets where light was to be furnished, and lights were connected ad libitum at any desired points between the station and the farthest end without reference to such trifling considerations as difference in potential. Distribution was attempted in this way for years, and in many places is still in operation. Lines are even being constructed to-day without any notion of a system of feeders and mains, although an almost perfect system for the maintenance of uniform pressure was in operation in many Edison stations before the first alternating station was in existence. Fortunately for the operators of such models of simplicity, the current delivered has usually been so small in quantity that with the proverbial No. 6 wire, which seemed to possess virtues not affected by distances, the difference of pressure between neighboring customers rarely exceeded 10 per cent.

A few more enlightened experts—plants were always installed by experts in the early days—eventually conceived the novel idea that if the drop, a little of which they had discovered by that time, could be confined to a greater extent to those portions of the lines where there were no lights, some might be spared from the lighting districts. A few feeder lines were therefore stuck in here and there to boost up the pressure where it was lowest.

The regulation was all effected by means of the dynamo field rheostat, and the pressure indicated by a voltmeter on the secondary of a transformer whose primary was connected to the bus-bars on the switchboard. A few lamps were also often operated by the same transformer to light the switchboard or other parts of the station. The station attendant was, of course, in absolute ignorance of the pressure at any point on the lines where lamps were used. The pressure therefore was usually run high enough to be on the safe side. The attendant was sometimes instructed to let his voltmeter needle follow gently the maneuvers of his ammeter, as there was thought to be a more or less intimate connection between volts and amperes and the volts ought not to be allowed to get too far behind.

If anyone ever breathed a suggestion of pressure wires it was probably his last breath. At any rate, he was never heard of again. What! Pressure wires with alternating current? Preposterous idea. Alternating and progression were considered almost synonymous terms. Antiquated ideas must be abandoned.

This faintly whispered need might, however, be heard again, so, to meet the emergency, a compensating voltmeter was produced that could be adjusted for any drop in the lines. It was ingeniously arranged so that a small series transformer in the main line would send currents opposing those operating the voltmeter, thereby making the needle or index drop back approximately proportionately to the current in the line. This device was a great help and caused the drop in lines to jump into prominence at once. It would be quite perfect if the drop in alternating-current lines were proportional to the current, but it is not. The power factor of ordinary alternating-current systems is usually quite low at light loads, and, except with very small wire, an ampere may therefore produce much more drop proportionately at light load than at heavy load.

One alternating-current station of which I have intimate knowledge has used pressure wires in connection with each feeder for years. There may be a few others, but they are rare exceptions even to-day.

The usual system of distribution provides a separate transformer for each customer. In many cases this implies the use of a very small transformer. It is impossible to make the efficiency of small transformers high. As each customer may at times use all of his lamps, he must have full transformer capacity for such an emergency. The ordinary ratio between maximum station loads and the number of lamps connected is in most case under 50 per cent. where meters are employed. The transformers then being of a total capacity equal to the number of lamps connected, average at best only 50 per cent.

1. Read before the National Electric Light association at Chicago, Ill., June 8, 1898.

of their rated capacity at the maximum station load. In most stations the average load generated is much less than 25 per cent. of the maximum load, and, therefore, with twice the transformer capacity of that represented by maximum station load, the average transformer load would not exceed 10 per cent. of the transformer capacity, all the year round.

The efficiency of the average modern transformer of usual size at 10 per cent. of its rated load is not over 65 per cent., and the average of transformers at present in use not more than 50 per cent. It is perfectly safe to say that there is not an alternating-current station to-day using individual transformers for each or neighboring customers that can show an average efficiency of distribution of over 60 per cent., and few can show over 50 per cent.

In Europe, it is, to some extent, the practice to use transformer sub-stations with low-potential distribution from these points. Transformers are cut in and out at these sub-stations by attendants according to the demand for current. It is doubtful if, after paying interest on the investment in property and housing for these transformer stations, together with the investment in instruments and switches required and the attendants' wages, there is very much saving effected. Had we nothing better to turn to than these systems, the cost of distribution from large stations would be extreme compared with the direct-current, Edison three-wire system, and competition with the latter could not be a success.

Another very important consideration is the economy or efficiency of lamps used. To employ successfully the highest-economy lamp made, a very uniform pressure must be maintained. With the usual

FIG. 3. FEATURES OF A PHILADELPHIA OFFICE-BUILDING PLANT.—SWITCHBOARD.

alternating-current system and with an equally good disposition of feeders and mains, the variations of pressure will exceed those in a direct-current system by nearly 3 per cent., on account of the transformer drop, and to secure even this limit of variation, pressure wires must be used with each feeder.

It is not surprising to find, therefore, that almost all alternating-current stations are using lamps requiring 20 per cent. more current than those used by direct-current stations.

I cannot refrain from remarking here that to operate any station, alternating or direct-current, without pressure wires, is to be worse than penny-wise and pound-foolish. In any alternating-current station employing overhead wires, the saving in lamp renewals would equal the cost of pressure wires in little over a month's time. I might also add that the total loss of lamps is not the most serious result of variations in pressure. Such variations cause a rapid decline in candle power, and low candle power means disaffection of customers and the increased use of gas.

Now, let us leave for the time the alternating-current station and its usual system of distribution, and adjourn to a modern Edison station, to see if there can really be anything learned from so antiquated a source. On entering, we see at first large direct-connected generators running in multiple. We have also seen those in a few alternating-current stations, and perhaps of larger size. We next see a very compact and convenient switchboard. Neither is that altogether new. But let us ask to see the system of distribution, for that is what we most want to look into.

On the plans of this system of distribution a remarkable network of feeders and mains is laid before us, most carefully calculated for the maintenance of uniform pressure. Means for regulating more or less independently the pressure on each feeder are provided. From numerous points in the system, corresponding to the feeder terminals, pressure wires are brought to the station, and indicators show the pressure at all these points. Numerous devices and appliances are shown us which must have been the result of years of experience in the development of distribution methods. We look with admiration, and ask why, with this apparently far more perfect system in existence, have we been working so long to try to perfect a new system that cannot to-day, we are informed, produce such results. Why, indeed!

But let us look a little further. What are those massive beams? They do not seem to support anything. "Those are not beams. They are copper wires to carry the current out," we are told. "Wires? Why, they weigh tons!" "So they do, but they are necessary with this system." A very serious drawback, it would seem. Another question troubles us. Why do you occupy ground in a part of the city where property must be very valuable? Why do you not go off to one side where land is cheap? "Oh, we are forced to be near our center of business. If we were twice as far away we should have to use four times the amount of copper in those bars." This, indeed, seems a very great defect. But are there no other defects in your system? In answer we are told that there are no others that are considered serious.

If this necessity for using such an enormous amount of copper is the weak point of a beautifully developed system, why do we not endeavor to overcome that particular point and adopt the rest, instead of starting out anew and alone to develop another system from beginning to end? This is the question that should have been considered years ago. Why did we not start where others left off, engraft our alternating current and draw energy and strength from the old roots, instead of trying to grow from the seed to find ourselves running to limbs and branches with very little trunk to speak of. We have tried to overreach our older brother, and now lack his sturdiness and stability.

It is not too late, however, to begin afresh. We are satisfied that at the present time the Edison three-wire system of distribution is the most efficient in use and the most nearly perfect in details. We know that the usual system employed with alternating current is not efficient, and does not admit of as close regulation, but it is vastly cheaper to install.

Comparing the cost of individual transformers and high-potential distributing mains with the three-wire system of mains at low potential, we do not find a great difference in first cost in favor of the alternating. We do find, however, that the Edison feeders for the same distance cost about 31 times as much as for alternating current at 1,100 volts, 125 times as much at 2,200 volts, or 500 times as much at 4,400 volts. It would then appear that if we could apply alternating current to the feeders at high potential and transform down for the mains, we might reach the lower first cost of the ordinary alternating-current system and possibly retain all the best features of the direct current. To accomplish the former, the transformers must be provided at a small proportion of the cost of the alternating-current feeder, and to do the latter, they must not increase the average losses in the system. It is obvious that we could with alternating current move our station to any reasonable distance from our center of distribution, and at comparatively small additional cost for feeders. The whole problem then seems to come down to transformer efficiency and means of regulation.

To consider the matter of regulation first, we see at a glance that we cannot use the direct-current method of regulation by supplementary bus-bars, but we can use the booster method, and can, moreover, apply a static booster to each feeder to regulate within any desired limits and with as small gradations as necessary. In fact, the booster method of regulation was first applied to alternating-current distribution, and operates with much less average consumption of energy than either the supplementary bus or direct-current booster method. In this important consideration we can therefore improve on and simplify direct-current methods.

The means of regulation having been in this way provided for the feeders, it remains to be considered what we shall do to eliminate the effects of transformer drop. As we have determined on a secondary low-potential, three-wire distributing system of mains, we can altogether dispense with high-potential mains and limit the high potential to the feeders. If we do this, we can conveniently have the transformers of the same unit capacity as the feeders, and arrange each with its primary connected to its independent feeder and its secondard feeding into the three-wire mains. We know that the effects of our feeder drop are eliminated if we regulate by pressure wires from the feeder ends. In the same way the effect of our transformer drop may be eliminated by bringing pressure wires from the secondary terminals. The feeder drop and transformer drop therefore become one, and are cared for in the same way. We can even secure better general regulation than with the direct-current system, as we have a better form of feeder regulator and have eliminated the effects of transformer drop.

Now, to return to the transformer itself and its efficiency. It is evident that, with this system, the transformer capacity need be no greater than that required for maximum station load, instead of more than twice that amount or nearly equal to that required for the total number of lamps connected. This at once doubles the average load on our transformers, and raises the average efficiency. It also incidentally reduces the first cost of transformers in still greater proportion. We also know, however, that transformer efficiency at light loads is dependent on the iron loss, and that this is interdependent with the regulation or drop. If we can increase the drop, we can decrease the iron loss, and thereby greatly increase the average efficiency. Having provided against any interference with the regulation of the system by the transformer drop, we can afford to increase that to the heating limit of the copper. In this way a 100-kilowatt transformer can be built with an average efficiency of over 98 per cent. The entire transformer loss can, moreover, be more than made up by the less loss in feeders, which we would naturally have with alternating current.

We have thus eliminated the two features in which the ordinary alternating-current system of distribution has been inferior to the direct-current, and have provided means for obtaining better regulation and higher efficiency at a very much less cost of installation than with the direct-current system.

This system was conceived several years ago, and it has since been my good fortune to have an opportunity to install a system of this kind on a large scale, which is now in very satisfactory operation. It is laid out exactly as three-wire Edison system would be, except that there are no sub-feeders. A network of mains is planned as if for use with direct current. The feeders are designed for 110-kilowatt maximum load at 1,100 volts, and at each feeder end is placed a 110-kilowatt transformer feeding into the three-wire network in the same manner and at the same points as with the direct-current system. The transformers are located in manholes of suitable design. From the secondary terminals of each transformer, pressure wires are run back to the station. Each feeder has an independent

GROUP OF CHICAGO EDISON MEN EMPLOYED ON THE PHILADELPHIA LAND, TITLE AND TRUST BUILDING.

regulator by which the pressure can be raised or lowered. There are no primary mains, nor any connection whatever between the primary feeders. The regulators perform two functions. They are used to maintain the proper pressure as indicated by the voltmeters and also to divide the load between transformers in any way desired as indicated by the feeder ammeters. It is possible to shift the entire load from one transformer and feeder to an adjacent transformer in this way without sensibly affecting the pressure on the system, and an equal division of load between transformers can be readily maintained at all times if desired. This is a very important consideration when very heavy loads or overloads are to be carried. The distribution of load on any large system is constantly changing as new customers are connected, and in large Edison stations certain feeders often become so overloaded that it is found necessary for their safety to put resistance in series with them to force some of the current to other feeders. The possibility of overloading any individual feeder beyond its share is absolutely provided against in the system described. To make the arrangement of this system perfectly clear it is illustrated diagrammatically in Fig. 2.

In Fig. 1 are shown four curves of station distribution efficiency. No. 1 is that of a representative Edison three-wire, direct-current station. No. 2 is the new alternating-current system described. No. 3 is the usual alternating-current system employing separate transformers for each customer or for adjacent customers, the best modern transformers being used. No. 4 shows the same system, but with the average transformers found on the lines of most existing stations. These curves were plotted from the following data obtained from actual practice:

	No. 1. Per cent.	No. 2. Per cent.	No. 3. Per cent.	No. 4 Per cent.
Feeder loss	24	8	10	10
Main loss	2	2	2	2
House wiring loss	1	1	1	1
Transformer loss, iron	.23	6	12	
Transformer loss, copper	2.7	1		.5
Total loss at maximum station load	27	13 93	20	25 5
Efficiency at maximum station load	78 7	87.9	83 3	79.6

The efficiencies of distribution at assumed average loads are shown to be as follows:

Per cent.	No. 1. Per cent.	No. 2. Per cent.	No. 3. Per cent.	No. 4. Per cent.
Load, 25	94.1	95.8	78.4	66.6
Load, 20	94.8	96.2	75.3	61.4
Load, 15	96.1	96.5	70.3	54.3
Load, 10	97.3	96.4	61.9	45 1

At maximum load it will be noticed that the efficiency of alternating current No. 2 is 10 per cent. higher than No. 1, the direct current. This means that the same energy can be delivered with 10 per cent. less capacity in generators, engines and boilers, or a difference of 10 per cent. in the first cost of generating plant. It is pertinent to remark here that alternating-current generators also have a much greater margin for overload for short periods than direct-current generators. The efficiency at average load, or the all-day efficiency of the No. 2 alternating-current system, is also shown to be appreciably higher than the direct current. In large central stations the average load is generally found in practice to vary from about 15 to 20 per cent. of the maximum, and it will be noted that from 12 per cent. average load up, No. 2 curve for the special system of alternating-current distribution shows a higher efficiency than the direct current.

It may be asked what effect the aging or fatigue of the transformer iron will have on these figures. I answer, none appreciable. Transformer manufacturers are willing to guarantee as low as one per cent. increase per year in iron loss. This means one per cent. of the actual amount of energy lost in the iron, so that, if this increase continued at the same rate, it would take 100 years to double the iron loss. Experiments tend to show, however, that this effect rapidly approaches a maximum, and that, therefore, the increase goes on at a constantly decreasing rate. The entire effect may be eliminated, if desired, about once in five years by reannealing the transformer iron at a very small expense.

It has been the practice in some European stations to cut out transformers during periods of light load, but it will be seen that cutting out transformers in the system described would only decrease the efficiency; in fact, the efficiency is higher at about the average load, and the system was designed throughout to accomplish this result. The less we say about curves Nos. 3 and 4 the better, as at small loads the efficiency is shown to be appallingly low.

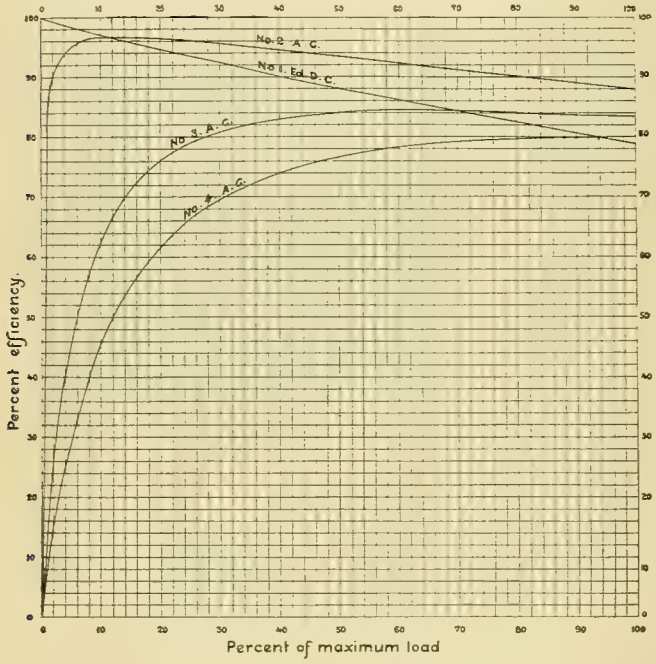


Fig. 1. Curves of Distribution Efficiency.

Extensions of Direct-current System by Alternating Current.

Several large three-wire, direct-current Edison stations are beginning to employ alternating current to extend their lighting territory beyond that possible or profitable with low-tension current. This is a recognition of alternating current which would not have been considered for a moment a few years ago. They now propose to use alternating current to transmit their energy at high potential to a distant substation, where it will be transformed to a lower pressure and then again transformed by means of rotary transformers to direct current, which is in turn distributed over the three-wire Edison system as if generated in the ordinary way. This is a very beautiful and instructive application of alternating currents, and ingeniously designed machinery. It gives the manufacturers a chance to sell additional machinery, swells the company's real estate investment and gives work to the unemployed to operate the sub-stations.

The loss in the conversion to alternating current and back is about 15 per cent. in addition to the loss in static transformers and lines. This distribution might be accomplished without the additional machinery, wire, real estate, labor, and loss in efficiency. It is hardly to be expected, however, that those who have grown up under the protection or influence of direct current would use alternating current and further than absolutely necessary until they have grown more accustomed to the new mode of travel. After looking across the stream to coveted territory for many years, they are willing to use the new bridge and to ride across at about the highest speed provided, but when they get on the other side they are more than satisfied to foot it again the rest of the way.

A much higher efficiency of distribution and better regulation, could be secured by using the alternating-current system as it is, without transformation to direct current, and everything could be controlled from the main station without employing labor or apparatus at sub-stations. Why do they not use it so? They say that many things cannot be accomplished as well with alternating current. If that is a challenge, we will accept it and try conclusions with them. Let us then anticipate these various objections and see what they amount to.

Efficiency.

We have already seen how a properly designed system of distribution for alternating currents may be made to exceed the direct-current system in efficiency, taking the latter under its most favorable conditions. If we then add to the usual losses in the direct-current system the losses in double rotary transformation and in static transformers, the very great difference in favor of the alternating current is still more marked.

Regulation.

It has been shown how very simple and reliable regulators can be provided for each alternating-current feeder, which will secure the closest possible regulation over any range desired, and this can be effected at a loss of less than one per cent. Such close regulation can only be secured with direct current by the use of a number of generators, connected to auxiliary bus-bars, or by conecting the feeder ends to adjustable resistance connected between the buses of two or more generators. The first cannot be realized in a rotary-transformer station, and the last is quite wasteful of energy. Regulators placed on the alternating-current feeders of the rotary transformers control alike the pressure on each rotary, and all the direct-current feeders supplied by the same, in exactly the same way as field regulation does on a direct-current generator. Such regulation can only be effectual with a number of small rotaries not operated in multiple. The best regulation can, therefore, undoubtedly be secured with the alternating-current system.

Operation of Arc Lamps.

It seems now to be the universal opinion among Edison station men that the enclosed arc, long-burning lamp is destined to replace all the old forms of arc lamp. We will, therefore, consider this type of lamp only. Fully as well-burning lamps of this type are now made for alternating current. They are also about as free from noise as the direct-current lamps. Many will say, however, that it is impossible to get as much light from the alternating current as from direct current. That is true if we state that the same energy in the arc produces less light with alternating current than with direct current. It has been determined that the alternating-current arc produces about 70 per cent. of the light to be obtained from the same number of watts in the direct-current arc. The usual direct-current enclosed arc requires five amperes at 115 volts, or 575 watts. How much of this is used in the arc? Somewhat less than 80 volts, or under 400 watts; the balance of over 175 watts being wasted in resistance.

With alternating current, 70 per cent of the amount of light would be obtained with this 400 watts, or about 570 watts would be required to produce the same light. The alternating-current arc is best operated at about 70 volts, but inductive resistance is used to bring the pressure down to this amount. This inductive resistance consumes about 10 watts actual energy, making in all 580 watts, against 575 for the direct current for the same amount of light. This difference of five watts, or less than one per cent., is insignificant.

The standard alternating-current enclosed arc consumes about 420 watts at the lamp terminals, but I have had made to order a large number of 550-watt lamps, which have replaced many series 10-ampere direct-current lamps. There are certain kinds of arc lighting to which the alternating current is particularly well adapted, of which I will speak later on.

Motors.

The greatest argument used against alternating current used to be that it would not run a motor. It has long ago proved that it can, and that without a commutator. This subject now brings us to multiphase systems. There are two of these systems in general use, the two-phase and the three-phase. Other systems are but modifications of these and will be mentioned as such. Motors can be operated with equal facility and efficiency on either system and have many distinct advantages over direct-current motors.

For long-distance power transmission the three-phase system shows an economy in copper; but for lighting, or for lighting and power combined, it is not at all well suited. I might say that where lighting is a distinct feature, and first-class service is to be rendered from a large station, the three-phase system cannot be used successfully. On even the best generators the windings are so entirely interdependent that a change of load on one phase will affect the pressure on the other two; but a defect even worse is the impossibility of regulating the phases independently for drop in the feeders if the load happens to vary differently on any two. Any regulator placed in circuit with one phase will effect about the same change of pressure in the adjacent phase within the usual limits of regulation. Regulation is then a question of the best possible averages, and at best is but guesswork. With the feeder and transformer drops found economical in practice, it would be practically impossible to keep the pressure sufficiently constant for high-efficiency lamps. The complication of wiring is also very serious, especially if the Edison three-wire system is used for distribution, as six wires would then be required, forming six circuits that must be kept balanced.

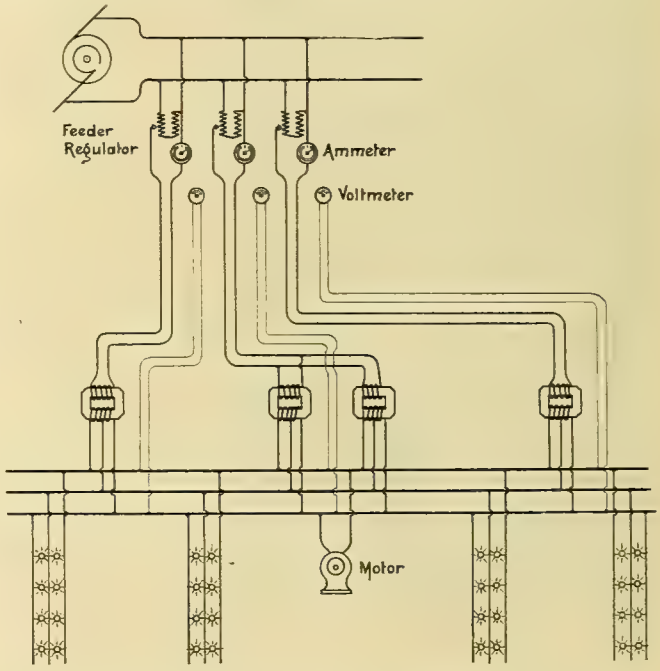


Fig. 2. Single-phase Alternating Current System with High-pressure Feeders and Low-pressure Distribution, Independent Feeder on each Transformer or Group.

GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY ALTERNATING CURRENTS.

The two-phase system is subject to the same objections unless the two phases are used separately for lighting, in which case we have the complication equivalent to twice the number of generators and feeders. For good regulation and simplicity the single-phase system cannot be equaled by any multiphase system.

The so-called monocyclic system is a modified two-phase system, in which current is distributed for lighting on a single-phase circuit only, and a third wire carries current in quadrature to the first, which, in connection with the first, is transformed to a three-phase relation wherever it is desired to operate motors. The regulation of this system can be made almost as good for lighting as the single-phase, and can be as simply effected. The third wire adds complication, but no balancing is required, as all the lighting is done from single phase on two wires. If low-tension, three-wire distribution is attempted with this system, a fourth wire must be used for power distribution.

A system practically the counterpart of the monocyclic is the three-wire, two-phase system, in which the lighting is all done on one single-phase, and a third wire is used in conjunction with the other two for power. It is handled in exactly the same man-

ner as the monocyclic system, the only practical difference being in the relative potential of the quarter-phase circuit. In the monocyclic the quarter-phase element of the generator winding is one-quarter the potential of the main winding, giving between the power line and the main lines a pressure of 55 per cent. of that between the main lines themselves. In the special form of three-wire, two-phase, the quarter-phase element of the generator winding is equivalent to one-half of the main winding, which causes a pressure between power line and main lines 71 per cent. of that between the main lines. For power distribution this system requires slightly less wire than the monocyclic. Fig. 3 shows diagrammatically the arrangement of this system used in connection with the special method of distribution already described. The diagram shows a system of two-wire mains for lighting, to which might be applied, of course, the Edison three-wire system. The motors used would most naturally be of the two-phase type, although three-phase motors may be used with equal facility by the method of transformer connections devised by Mr. Scott.

It can be readily seen that while these systems are much better adapted to general station distribution than the two-phase or three-phase, they still lack the simplicity of the single-phase, and both require more wire. Fortunately, we can now obtain single-phase motors which equal the multiphase and direct-current motors in efficiency and almost all desirable points. They start readily with load and may be operated with variable speed; in fact, they equal the direct-current shunt motor in all points, excelling it in efficiency and simplicity.

We can meet the direct-current advocates on the power question, therefore, on at least an equal footing, save only one application met in central-station practice; namely, the operation of high-speed elevators. The alternating current motor, multiphase or single-phase, cannot be controlled for this work as readily as a compound series, direct-current motor. It has taken several years, however, to perfect the mechanism for the control of direct-current elevator motors. Give us the same time, and we will do it with alternating current. This field for power has only of late been opened to direct-current stations, and it is yet a question for debate as to whether it is a paying one.

Special Applications of Current.

There are many special applications of current met with in practice, most of them bringing a small return, such as electro-plating, electro-cautery, charging small storage batteries, electric heating and cooking, etc. The first three require low-potential currents, and are economically effected only by motor generators or rotary transformers. It is evident that this transformation can be accomplished as readily with alternating current as with direct current. Electric heating and cooking are as yet luxuries, and cannot be depended on for much revenue. They can be done with equal facility by alternating current.

Storage Batteries.

Here we come to the direct-current advocate's last and greatest stronghold. To this he retreats with great confidence of safety. We may ask first whether storage batteries have yet been proved to be a valuable adjunct to the central station, cost and maintenance considered. It is true they are being tried by several large stations, and we watch eagerly for the results. They equalize the station load to a greater or less degree, and cut down the generator capacity for the peak. Are they, however, cheaper than generators, engines and [illegible] the same capacity? Are the losses in transformation less than the cost of a few more attendants? Is their maintenance less expensive than that of generating apparatus? These questions [illegible] answered in the affirmative. But the battery man's most sanguine hopes be realized, what then? If rotary transformers are good enough for the direct-current man to use to change the direct current to alternating current, transmit a good proportion of his load to a distance and transform again to direct current, why should not the alternating-current man use them to charge his batteries and then to transform their output back to his pet form of current? Loss in transformation, do we hear someone say? Not any more than with our contemporaries' long-distance transmission system, and, in this instance, they are small and unimportant, we are told. There is at least one station in the country where storage batteries are being used in this way, and I believe with success, as storage batteries go.

Have our direct-current friends anything more to bring forward? Or have we forced their last position? Well, we will declare a truce, and acknowledge that they fight bravely. We have learned as much from them as they can learn from us. If we had been as quick to acknowledge their beautifully designed distributing details and applications as they have been to appreciate a few of the advantages of our current, we might have been nearer together, or even hand in hand, long ago. As it is, we are both working to the same end, and our paths must join sooner or later as they converge.

Before closing, I wish to recapitulate a little, and draw your attention more forcibly to the flexibility of the alternating-current system. We all know of the many applications to which this current is now put, and what we have described here is, most of it, not new to many of us. The use of the rotary transformer has been widely talked of and described for the last two years. The facility of operating lines at any potential desired, through the means of step-up and step-down transformers, is no longer an experiment. Multiphase motors are familiar to all, while single-phase motors have been much talked of and written about, and failures have, time and again, followed boasted success. Many of us, however, have within the last year seen them quietly at work, thoroughly tamed and domesticated. One large station is using them extensively, and is so thoroughly convinced of their success that it has discarded all notion of using multiphase distribution, although it is using generators that can be operated two-phase if desired. Direct-current motors are being rapidly replaced by these single-phase motors to secure uniformity of system.

Arc lamps have been familiar to us on alternating-current circuits for some time, and the alternating current, enclosed, long-burning arcs are now numbered by the thousands. Street lighting is still, however, in most places done on the direct-current series system, and even the largest machines yet built for this purpose are very small in comparison with our large direct-connected generators.

The great desideratum in central-station practice is to be able to employ one system for everything. All current for all classes of service should be supplied from but one type of generator, be this direct current or alternating current. In this way only can the maximum output be accomplished from a given investment in machinery and apparatus, and the greatest economy in operation secured. This has been accomplished in many stations where a limited range of service [illegible] to be provided. Arc lighting has, of all, been the most troublesome to provide for. How shall we operate our arc lamps from our incandescent lighting system? has been the anxious inquiry. The constant-potential arc lamp has answered this question for commercial lighting, but city street lighting cannot be so easily provided for. The Edison companies have done a limited amount of this from their three-wire system, but this can be done to advantage only in districts where mains have been provided for commercial lighting. For extended arc lighting, the small series machine with its belts and clutch pulleys still holds the fort.

I am able to state, however, that one large company has recently solved the problem to its entire satisfaction. This company furnishes 2,600 street lamps to the city, lighting some 300 miles of street. These were operated by a small army of series arc machines. They were installed by a company that was acquired by purchase by the one first mentioned. As this company had long since adopted alternating current for its entire distribution, it was extremely desirable to be able to operate these city lamps from its large direct-connected alternators, thereby saving in fuel, attendance, floor space and reserve investment.

After a few months' trial of an experimental circuit with alternating current, it was found perfectly feasible to operate the same direct-current lamps, slightly remodeled, on the same circuits of 60 or 80 lamps in series. A system of this kind was, therefore, adopted and the company now has 2,300 of these lamps in regular operation by alternating current in this way. The circuits are each provided at the station with a regular step-up transformer of a maximum capacity of 4,000 volts and 10 amperes, and the feeders to these transformers are treated on the switchboard in the same way as the feeders for incandescent lighting. It is quite usual for one generator to carry 2,000 of these lamps. The lighting is satisfactory to the city and the lamps give better service than when operated by direct current. There has been a very marked saving in fuel and attendance. The indicated horse-power per arc lamp is considerably less than with the direct-current arc lamps operated in the usual manner. Fig. 4 shows this system in diagram.

I know of no other place where this is being done, and it stands as a very pronounced example of the flexibility and adaptability of alternating currents.

There have been a great many problems in the operation of large alternating-current stations that have been discouragingly difficult of solution. The handling of high potentials on switchboards, the operation of generators in multiple, with facility, and scores of more or less important difficulties, have, one by one, been surmounted, the burden of the work usually falling on a few of the pioneer stations.

In summing up, we find the following marked features in which the alternating current, properly installed, has been shown to have pronounced superiority over the direct current:

Highest possible efficiency of distribution and operation.
Best regulation.
Largest territory desired readily supplied from one station.
Comparatively small cost of feeders, effecting enormous saving in investment.
Least cost of real estate.
Cost of installing and operating sub-stations entirely avoided.
The only system in which all classes of service can be supplied from one type of generator.
Greatest flexibility.

In closing, I wish to thank my friends and co-laborers of the direct-current faith, from several of whom I have had the pleasure of learning much that has proved of great value to me.

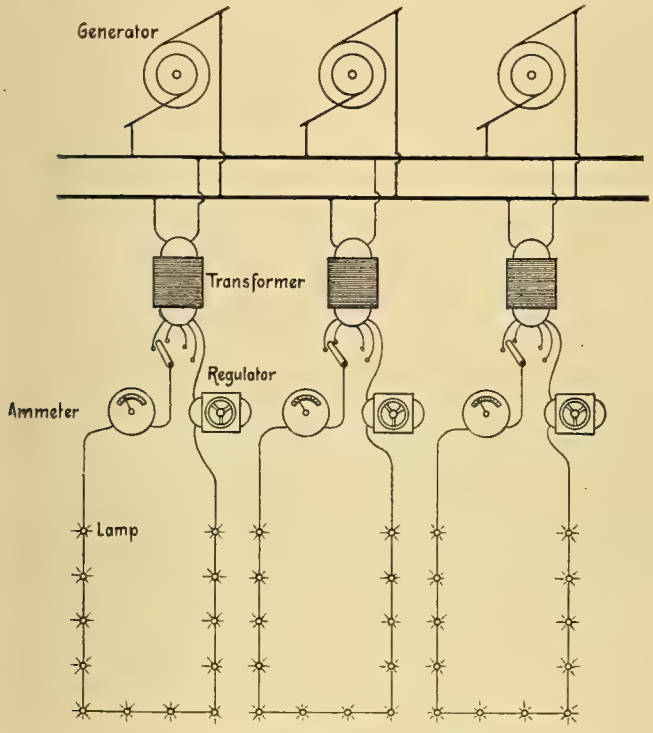


Fig. 4. Alternating Current Series Arc Light System.

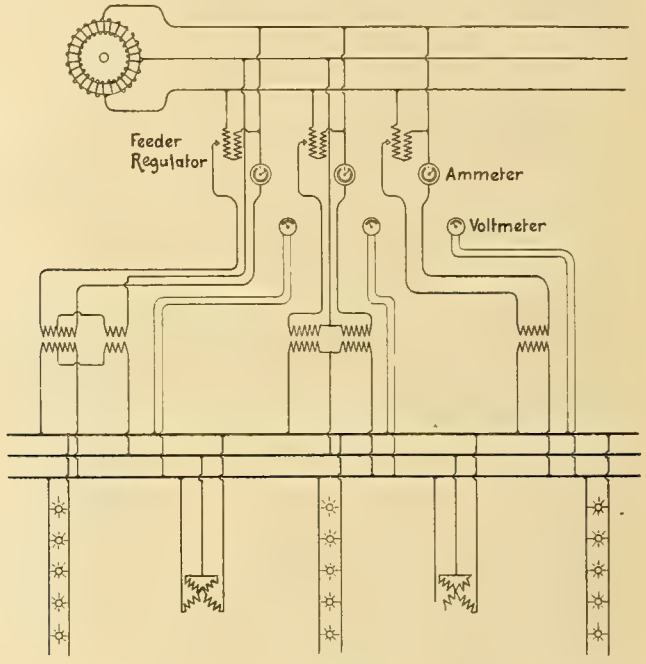


Fig. 5. Three-wire Two-phase System with Single phase Lighting High pressure Feeders and Low pressure Distribution.

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In Yankton, S. D., the street-railway company objected to paying an assessment of $400, and the property was sold by the city to satisfy the tax judgment. Only one bid was received and the system was disposed of at a remarkably low figure—much less than the city's claim. It was learned subsequently that the company was the purchaser, and it is now reported that the price paid and the expenses involved amounted to $246.

The action of Judge Showalter in refusing a temporary injunction to the Western Electric company against the Kellogg Switchboard and Supply company, restraining it from equipping the Kinlock Telephone company of St. Louis with switchboards and instruments is significant in view of the fact that the petition was based upon the Firman patent which had already been sustained by a court of equal jurisdiction. Judge Showalter pointed out, however, that the Firman patent would soon expire, that the decision upholding it was not recognized as an authoritative exposition of the law, and, at any rate, it was based upon very narrow grounds. Moreover, the court was convinced that the Kinlock company and the Kellogg company were financially responsible and that the interests of the complainant were safe, whereas a great injury would be inflicted upon the defendant if the temporary injunction should be granted at this time and then found to be untenable. Judge Showalter promised to file a written opinion in the case, and its publication will be looked forward to with interest by the independent interests of the country.

For the first time in many years the Patent Office has a sufficiently large force to handle the business in an expeditious manner. On July 1st 28 examiners were added to the commissioner's staff and a corresponding increase was made in the clerical force. The work of this office has been steadily increasing, and during the year ended June 30th there were filed 40,196 applications for mechanical patents, 1,831 applications for designs, 93 applications for reissues, 1,928 caveats, 1,891 applications for trademarks, 175 applications for labels, and 30 applications for prints. There were 22,731 patents granted, including reissues and designs; 1,455 trademarks, 71 labels, and 18 prints registered. The number of patents which expired was 14,167. The number of allowed applications which were by operation of law forfeited for non-payment of the final fees, was 4,754. The total receipts of the office were $1,253,948.44, the total expenditures were $1,081,633.79, and the surplus of receipts over expenditures, being the amount turned into the treasury, was $172,314.65.

Commissioner Duell says that the work which has been so far behind because of lack of facilities for handling it will be brought up to date and kept there. This announcement will be received with general approbation throughout the country.

An unlooked-for complication has confronted the Internal Revenue Department in its efforts to enforce the provisions of the war measure requiring the placing of stamps on telegraph messages. The representatives of the department have been making examinations of telegraph dispatches that have been received for transmission at offices throughout the country, to see if they have had the necessary stamps attached, and this has called forth protests by many against the exhibition of private messages that have been filed, as they are considered to be sacred from the eyes of all except the ones directly interested and through whose hands they must pass in transmission. These complaints have reached the commissioner of internal revenue, and as they have been of such a nature that they could not be ignored, he has issued a circular to collectors and revenue agents in which they are advised that such examinations in the future are to be restricted to simply ascertaining if the messages have been properly stamped. The telegrams may be shown by a representative of the company in such a manner that the officer making the examination shall be able to see that the messages have been stamped, and it is considered unnecessary for him to have any knowledge of the contents of the telegrams. It is believed that this ruling will satisfy the objections already raised and restore confidence on the part of the patrons of the telegraph companies.

In his annual address as president of the Municipal League at Detroit on August 1st, Mayor MacVicar of Des Moines admitted the predominance of the vicious element in the political organization of municipalities, and the danger of entrusting public works to the management of this class, yet he believed that municipal reform could only be secured by a bold stroke, and he advocated, therefore, the immediate extension of the powers of municipalities:

To my mind it would be suicidal to enlarge the functions of municipalities without providing for the thorough application of the merit system in appointments, promotions and removals. We who believe in municipal reform are in the paradoxical position of proclaiming that our cities are doing badly that which they are doing, yet urging that they assume new duties. But the logic of our contention is better than it seems. Nothing could do more to bring out the latent virtue of the indifferent citizen than to freight the ship of state, already, as he fears, overloaded, with still dearer interests. I am not afraid to startle our money-making voters by producing a situation which will alarm them into a state of perpetual political vigilance. They need to be alarmed. Arouse them to the seriousness of the prevailing conditions, and the spasmodic energy which now cleans the Augean stables of municipal corruption once in 10 or 15 years will be harnessed by unavoidable necessity for regular activity.

To suggest such a plan as this indicates a desire on the part of Mayor MacVicar and his followers to force their views on the community rather than to serve the public. The scheme is simply preposterous. Without honest officials, under the system proposed, the city would be in bankruptcy before the "money-making voters" could be aroused, while with competent and reliable men the affairs of a municipality could be conducted much more economically if the lighting and other public works were done under contract. It would seem to be much more practical for municipal reformers to bend their energies toward securing competent and trustworthy men for office than to increase the opportunities of the boodlers to loot the city treasury. Mayor MacVicar and his associates may rest assured that if they give the boodlers an opportunity they will take advantage of it.

From very early times certain contracts in restraint of trade have been held void as against public policy. They have been pronounced objectionable on two grounds. First, they tend to deprive the individual restrained of the means of earning a livelihood; and secondly, they deprive the community of the benefit of his free and unrestricted efforts in his chosen field of activity. But a distinction has for some time been recognized between contracts involving a partial restraint of trade and those requiring a complete retirement from business, the former being held valid if not unreasonable and the latter positively invalid. The Supreme Judicial Court of Massachusetts has recently been called upon to review a case in which some interesting features were presented. The action was instituted by an electrical company and the facts may be briefly stated as follows:

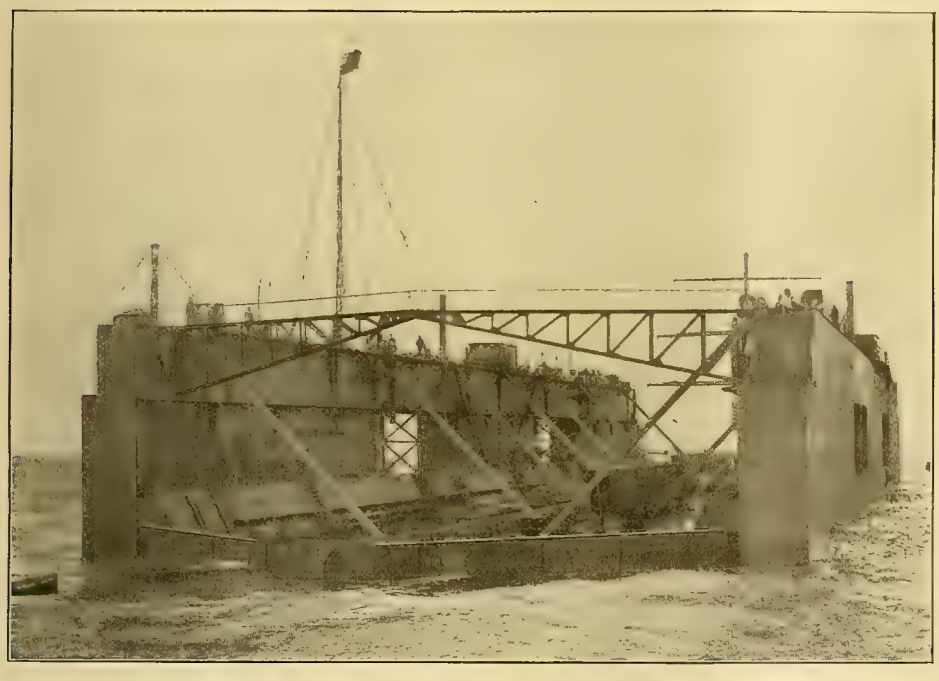
The three business managers of as many different corporations entered into an agreement to form a new corporation, to which each of their respective corporations was to sell all its assets, discontinuing the business of manufacturing and dealing in electrical goods or specialties of any sort or description. The three managers themselves signed an agreement that they would not thereafter at any time, directly or indirectly, as partner, agent, officer of a corporation, or in any other capacity, enter into or conduct, or assist in conducting, any business that should in any way interfere with or compete with the proposed business of the new corporation for a period of five years, except that any one of them should sever his connection in consequence of at any time being put at financial disadvantage by the other two in reference to salary or income.

This agreement the court holds to be valid. It says that inasmuch as the stipulation was only to do no business for five years that should interfere with or compete with the proposed business of the new corporation, it seems quite clear, under the authorities of that state, that the stipulation went no further than was reasonably necessary to protect the good-will of the business sold by each contracting manager's corporation, and that it should, therefore, be held valid. Nor does it think that any distinction should be made, in this connection, between competition with the business of the new corporation and competition with the business sold by one of the managers and his company, where the business sold was chiefly installing and constructing electric plants and appliances, while the business of the new corporation included with this that which formerly was done by the other two companies, namely, manufacturing and dealing in electrical appliances. In other words, it holds that the stipulation not to compete with the business of the new corporation was as binding on the manager as if it were merely not to compete with such business as previously had been done by his particular electric company.

WAR NEWS.

Electrically Equipped Floating Dry Dock.—The beginning of the war with Spain found this country without a floating dry dock, and, as a consequence, all exterior repairs to fighting ships have been made in the navy yards. This arrangement was not satisfactory, however, as it necessitated sending disabled vessels a considerable distance and occupied much valuable time. Now, however, the government has secured a floating dry dock and it will be sent at once to Cuban waters. It is not large enough to accommodate battleships and cruisers, but it will be able to handle the gunboats and small craft that have been doing blockading duty at Havana. It is 235 feet long and can accommodate vessels of 2,500 tons.

Naval authorities have directed longing glances toward the harbor of Havana ever since the need of a floating dry dock was apparent. The Spanish government, at the beginning of the present trouble in Cuba placed an order for a floating graving dock with an English shipbuilding company, and a year ago the finest vessel of this description afloat was turned over to the navy of Spain. The cost is said to have been $900,000. This dock embodies the best features of the floating and graving types and its equipment is pronounced by naval experts the most complete in the world. It comprises a watertight box, into which a vessel sails, and from which the water is then pumped, leaving all or a portion of the hull dry for examination or repairs. The dimensions of this dock are length over all, 450 feet;



ELECTRICALLY EQUIPPED FLOATING DRY DOCK.

clear width, 82 feet; depth over the sill, 27 feet six inches; draught of water under these conditions, 42 feet six inches, and the freeboard four feet two inches. The extreme width of the dock is 109 feet. There are five pontoons, the three middle ones being rectangular and those outside being finished to a point. These are entirely separated and they are arranged between the two walls, to which they are strongly bolted. Each pontoon is divided into four watertight compartments, and each wall is divided into five watertight compartments, making not less than 30 watertight spaces in all.

The equipment includes a complete electric-lighting plant and an elaborate power-transmission system, including motors for driving the pumps and operating the hoists. There are two electrical generating plants on the dock, one in each wall, and they are so arranged that they can be used separately or together. Each plant has its own complete outfit of boiler, engine and direct-connected generator. There are 10 electric motors—five in each wall—the controlling switches, rheostats, etc., being in the valve houses. The motors are mounted vertically and are directly connected to the shafts of horizontal centrifugal pumps at the bottom of the walls. Motors and pumps run on ball bearings. The pumping machinery is capable of raising 15,000 tons of water in 2½ hours. The dock has a captain, officers and crew, and is fitted with foremast, jiggermast, steam steering gear, steam windlass and anchors. The manila hawser with which the dock was towed to Havana was especially constructed, being 22 inches in circumference and weighing nearly five tons. The illustration presented on this page shows the special features of construction of the Havana dock, and is here reproduced through courtesy of the Scientific American.

American Electrical Trade.—It is expected that American manufacturing interests will be greatly benefited by the success of the American arms in Cuba and that the electrical interests will be among those especially fa[illegible] "first order from our new possessions in the West Indies," is claimed by the Westinghouse Machine company, which announces that it ha[illegible] that its New York office has receive[illegible] a complete steam plant, involving a 100 horse power Westinghouse engine and W[illegible]house generator, together with boiler, pump, piping, etc., to be installed in Santiago de Cuba.

X-rays in Hospital Work.—[illegible] X-ray has been introduced systematically in the examination of wounded soldiers brought back from Santiago. Last week a number of patients at the Marine Hospital, Stapleton, S. I., were subjected to X-ray experiments at the Long Island College Hospital. Guy Lamberson, Company B, Second Infantry, who has been suffering from a gunshot wound of the right forearm, was one of the men. A Mauser bullet, 1¼ inches in length, was located in his right wrist. Dr. Stoner removed the bullet. Edward Culver, a rough rider, was also examined and a bullet was found lying near the sixth rib on the left side of the body. Culver says this bullet is the one which killed Hamilton Fish and afterward struck him.

Mines in Santiago Harbor.—A newspaper correspondent who accompanied Commodore Schley when the latter inspected the harbor and fortifications of Santiago relates an interesting incident of the trip disclosing the location of the mines and method of operation. An officer of a tugboat was found, who said he had been employed in taking troops from the batteries at Morro. He did not know how many sailors had returned or escaped from Admiral Cervera's squadron, but he believed there were only a few. He directed Commodore Schley to a wooden house on the side hill, where lay, he said, the electric plant for setting off the harbor mines. "Our launch, running alongside a small wooden pier on the west of the harbor, found a launch from the Reina Mercedes, with a number of Spanish sailors and a marine officer in charge. The latter conducted Commodore Schley and the party by a line of filthy houses to a rough wooden shanty, thatched with palm leaves. In this place was a beautiful apparatus, with electrical batteries to set off the mines. The officer explained that two were exploded, having been set off the night the Merrimac entered. The keyboard shows about six rows of mines, and Commodore Schley believed it would be wise to set them off, but he refrained from taking action in the absence of Admiral Sampson."

Use of Searchlights in Santiago Blockade.—Accompanying the official report of Admiral Sampson upon the destruction of Cervera's fleet are several orders which were issued by him, assigning the several vessels in the squadron and directing their movements. One of these orders relates to the operation of the electric searchlights. It is dated June 8th, and contained the following instructions:

During the dark hours of the night searchlights will be used as follows. The Iowa, the Oregon and the Massachusetts will take turns of two hours each, i. e., from dark to 8 p. m., and from 10 p. m., etc., in keeping one searchlight directly on the harbor entrance, maintaining carefully during that time their blockading positions. Should a vessel's lights fail, the next in order will at once take up the duty.

The picket launch and vidette stationed south of the Morro will move to one side or the other sufficiently to get clear of the beam of light.

The vessels on each flank, the Brooklyn and the Texas on the western side, the New York and the New Orleans on the eastern side, will take two-hour turns in using one searchlight from time

[illegible]

Engineers for Porto Rico.—Word was received at Camp Townsend last week that the regiment of engineers which has been formed at that point under command of Colonel Griffin would start for Porto Rico at once. The volunteers have been in active training for a month and are now well drilled for service.

The special correspondent of the Western Electrician at Niagara Falls reports that electrical circles in that section are interested in the announcement that the First Regiment Volunteer Engineers is to go to Porto Rico. This regiment includes five Niagara boys among the officers. These men are J. R. Haskins, Archibald R. Livingstone, James Elliott Hewes, Edward Sawtelle, William Hopkins, Francis M. Blacklock and Edwin J. Murray. Lieutenant Haskins was formerly a private in Company E, Third New York Volunteers, as was also Lieutenant Hopkins. While at Camp Black they were transferred to the First Regiment Volunteer Engineers at Camp Townsend, and while there received their commissions. Lieutenant Haskins is a son of Colonel Haskins of the Second United States Artillery at Fort Adams. While at the Falls Lieutenant Haskins was connected with the Niagara Falls Power company, and Lieutenant Hopkins with the Carborundum company. Lieutenant Hewes is also an electrical engineer, and was with the Acetylene Light, Heat and Power company, which was the old carbide company. Lieutenant Livingstone was connected with the contracting firm that built the extension to the Niagara Falls Power company's wheel-pit. Sergeant Blacklock was connected with the Niagara Falls Power company as an electrician, and Corporal Murray is a son of Superintendent Murray of the Niagara Falls Water Works company, one of the allied companies of the Niagara Falls Power company. While at the Falls he was on the engineering corps of the Cataract Construction company. Lieutenant Sawtelle is of Washington, a son of General Sawtelle. He was located in Buffalo, but lived at the University Club at the Falls, where he is well known in electrical circles. The regiment to which they belong is made up of professional men, mostly electrical or mechanical engineers.

Telegraphic Communication with West Indies.—At the Western Union Telegraph company's office announcement was made last week that all messages to or from Havana must be in the Spanish or English language, by order of the United States government. The company has been advised by the West Indian and Panama Telegraph company, which owns the cable to Porto Rico, to decline messages for all stations in Porto Rico except San Juan.

At Madrid it is admitted in official circles that no dispatches have recently been received from Captain-General Blanco, and it is added that the Spanish government is "considering the means of restoring communication with Cuba, as before the surrender of Santiago." It is reported at Washington that as a result of the sealing of the Santiago-Cienfuegos cables, several cipher dispatches passing between General Blanco and the Spanish government have drifted into this country. It is scarcely necessary to say that they did not reach their destination.

The change of base in the Porto Rico operations compelled a complete rearrangement of the plans of the Signal Service for the campaign. There was no direct cable connection made with the army at Guanica, as would have been the case had the original landing place been taken, and the war balloons, instead of being sent ahead, will be held at Tampa pending further developments. The original plan, as decided on by the war authorities, was for a landing of the expeditionary forces at Fajardo, at the northeast corner of the island. All these had to be abandoned, in view of the landing at Guanica, a point diagonally across the island and far away from any possible cable communication.

All efforts to establish a cable service there were abandoned, as the nearest point at which a new spur could touch an existing cable was San Domingo, 100 miles or more away. General Miles pushed on so rapidly, however, that the temporary break in the plans was not felt. On his arrival at Ponce he found that the Spanish telegraph force had destroyed the equipment at that point before its hasty retreat.

On July 29th Gen. Greely received a dispatch from Col. Allen, at St. Thomas, where he secured the services of an operator and made arrangements to open cable communications with Ponce. Col. Allen says Gen. Miles is well provided with telegraph supplies, and the military lines will be extended as rapidly as the army moves. The cable company agreed in advance to permit the Americans to establish communication as soon as Ponce was actually taken.

[*Continued on page 80.*]

DEVELOPMENT OF THE TELEPHONE FIELD.

Important Telephone Patent Decision.

A patent decision of great importance to the independent telephone movement was given by Judge Showalter of the United States Circuit Court at Chicago on July 29th, in the case of the Western Electric company against the Kellogg Switchboard and Supply company, in which the complainant sought to restrain the defendant from installing a switchboard for the Kinloch Telephone company of St. Louis. Judge Showalter denied the petition for a preliminary injunction.

The complainant applied for an injunction on the Firman patent, which will expire on January 19, 1899, the validity of which had been recently sustained by Judge De Haven, of the United States Circuit Court, Northern District of California, upon very narrow lines. The decision in California has been appealed to the United States Circuit Court of Appeals. Relying upon that decision, however, the complainant here sought to obtain an injunction and thus prevent the Kinloch company from beginning operations, as had been planned.

Affidavits of Prof. Elisha Gray, Prof. H. S. Carhart of the University of Michigan, and Milo G. Kellogg and F. W. Dunbar were presented showing that there was no infringement.

Judge Showalter declared in substance that it was his impression that there was no invention in the Firman patent, that he was unable to see upon what ground Judge De Haven had sustained the validity of the patent, in view of the prior state of the art and especially in view of the Dumont English patent of 1851, and advised counsel for complainant that, in his opinion, if the case went to the Circuit Court of Appeals, great difficulty would be experienced in sustaining that opinion. He also mentioned the fact that one of the decisions cited by Judge De Haven in his opinion has been discredited by the Circuit Court of Appeals of this circuit, in an opinion filed only a few days ago, and that it was very doubtful, to his mind, whether there was any invention in the Firman patent, or if there was invention, it was extremely doubtful if the defendant had infringed the patent. He said, however, that he preferred to place his decision at this time broadly upon the principle that the telephone company at St. Louis was engaged in a public service, that the question raised was doubtful, that the defendant switchboard company was undoubtedly solvent and would be able to pay any damages that might be recovered if the complainant should succeed in establishing the validity of the patent and the fact of infringement, and that it would, under such circumstances and also in view of the early expiration of the Firman patent, be an abuse of discretion for him to entertain the petition for an injunction, which he thereupon denied.

The Kellogg Switchboard and Supply company, which is a Chicago corporation, has for about a year been constructing the switchboard for the Kinloch Telephone company at Highland Park, Ill., where it has had from 50 to 200 men employed. Had the injunction been granted at this time, as sought by the Bell telephone interest, it would have been of great damage to the Kinloch Telephone company of St. Louis, and would have been discouraging to the independent telephone movement throughout the country. The switchboard whose construction was attempted to be enjoined is being made under the patents of Milo G. Kellogg of Chicago, and has a present capacity for 6,160 telephone lines and provides for an ultimate capacity of over 20,000 lines in one exchange. The largest telephone switchboard heretofore constructed has a capacity for switching only about 6,000 telephone lines in one exchange, it is claimed.

The Kinloch Telephone company is now nearly ready for business in St. Louis. In the affidavit of Hopkins J. Hanford, the general manager of the Kinloch company, it is stated that that concern is organized under the laws of Missouri for the purpose of constructing and operating a telephone system and exchange in the city of St. Louis. The company has a capital stock of $2,000,000. It contemplates the establishment of an exchange having a membership of 15,000 or more. It has now over 5,600 contracts executed with subscribers for five years' service from August 1, 1898. It has expended over a million dollars in construction work. It has built 106 miles of underground conduit in which the cables are in place, and has erected 7,600 poles. It has strung copper wire metallic circuits for an exchange of 5,000 subscribers. It has placed 4,000 telephones in residences and business places and connected them with the central office of the company in the Century building, and is putting up more every day.

The decision of Judge Showalter will be welcomed by the independent interests of the country.

Extensions and Improvements.

J. C. Pike and H. S. Bruce propose establishing a telephone system at Bolivar, Mo.

W. B. Aris, manager of the Spokane and British Columbia Telephone company, announces that the company will begin to put in a complete telephone system in Spokane, Tacoma and Seattle soon.

In the Supreme Court of New York Justice Kellogg filed an order recently denying an application made on behalf of Simon Sterne for the examination before trial of the officers of the Metropolitan Telephone and Telegraph company, now the New York Telephone company, in his suit brought to compel the company to furnish telephone service at a reasonable rate. Mr. Sterne recently obtained leave from the court to serve a supplemental complaint on the latter company. An application made by Mr. Sterne for leave to examine the books of the two companies was denied. Justice Kellogg also decided that Mr. Sterne had no case against the New York Telephone company, saying that it had a right to fix its own rates.

I. J. Kusel, formerly president of the Missouri Telephone Manufacturing company of St. Louis and recently connected with the American Electric Telephone company of Chicago, has severed his connection with the latter institution and allied himself with the latest comer in the independent telephone field, the Victor Telephone Manufacturing company of Chicago.. Mr. Kusel is one of those energetic telephone men whose aggressive efforts have made him a reputation in the independent telephone field. He started in a modest way in St. Louis, but he rapidly mastered the business and he has now a host of friends. The Victor company starts in an energetic manner. The company has a well-equipped factory in the hands of men competent to produce modern and scientific apparatus. It is said that the company has strong financial backing. President Blaine of the company has been a successful man in other fields and he enteres the telephone business realizing its great future and apparently with the full knowledge of the necessity of presenting the best and most modern equipment to bring about success in a field where competition is so strong.

Telephone War in Washington.

One result of the policy pursued by the Bell company at Washington was the enactment of legislation restricting the legal rate of telephone service in the District of Columbia to $50 per year. The Chesapeake and Potomac Telephone company, the local representative of the Bell interests, is now engaged in litigation an effort to enforce the rates. In the bill making appropriations for the District of Columbia, the paragraph providing money to pay the rentals of the instruments used by the District government was amended by the addition of a declaration that, hereafter, in the District, $50 a year should be the maximum price to be collected by the company for the use of a telephone.

The law went into effect on July 1st, but the company paid no attention to the $50 provision. Since then a dozen or more suits have been filed in the local courts, some for the issue of writs of mandamus to compel the company to furnish telephone service at the rate fixed by the law, and others for writs of injunction to restrain the company from depriving subscribers of their telephones who have refused to pay more than the rates prescribed by law. A test case was heard by Judge Hagner and was taken under advisement on July 27th. The telephone company set up as the grounds for refusing to observe the law:

1. That it was unequal and unjust in its operations, compelling every subscriber to pay the same amount for his telephone, irrespective of the use he made of it.

2. That it applied only to the telephones used by the District government, not to those of the public generally.

3. That it violates the constitutional guarantee against the confiscation of property, in that the rate prescribed will not pay operating expenses and a fair return on the investment of money in the plant.

The case will go to the Supreme Court for final determination, and the decision of that tribunal will be far reaching, for, if the power of Congress to regulate and fix rates in the District be sustained, and it be shown that the maximum rate fixed, $50 a year, be reasonable, that figure will doubtless be taken as a basis for fixing the maximum rental for the use of the telephone throughout the United States.

Michigan Telephone Association.

The annual meeting of the Michigan Telephone association, composed of the independent companies of the state, was held at Grand Rapids on July 26th. It was reported that the Detroit company has connection with 150 towns, the Grand Rapids exchange with 200 and the Saginaw system will soon be in operation with 50 town connections. The Grand Rapids and Detroit systems will be connected by way of Lansing. The total number of independent telephones in the state is about 16,000. The following-named officers were elected: President J. B. Ware, Grand Rapids; vice-presidents: W. L. Holmes, Detroit; C. K. Monroe, South Haven; George W. Finch, Escanaba; secretary, Alexander G. McLeod, Detroit; treasurer, J. H. Fildew, St. Johns.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The telephone company at Clarinda, Ia., has just completed a number of changes for the betterment of the service.

It is understood at Des Moines, Ia., that the Iowa Telephone company will sue for peace with the council. It will grant the right of the council to regulate rates and will suggest rates which it regards reasonable, and ask the council to refer them to persons competent to judge. It will also open its books in order that reasonable rates may be determined from the business the company has done. It asks to add 10 per cent. to the actual cost of maintenance and operation. Finally, it will ask to be permitted to make long-distance connection without dividing its business with the Mutual or giving it connection.

It is understood that there will be several bidders after the telephone franchise in Duluth, Minn. The council will offer it to the highest bidder at the expiration of the present company's franchise.

A. J. Vance expects to have a telephone exchange in operation at Dillon, Mont., in 30 days.

The Cedar Valley Telephone company is working to establish a telephone exchange at Gladbrooke, Iowa.

A local telephone company is being formed to put in an exchange at New Richmond, Wis. It is thought 75 instruments can be put in at the start.

William Richards, superintendent of the Wisconsin Telephone company's office at Menomonie, Wis., has gone to Grand Forks, N. D., to accept the management of the Northwestern Telephone Exchange company's office.

A telephone line has been extended to Mitchellville, Ia.

Dr. Chamberlin's independent telephone system at Stratford, Ia., is completed and in operation.

The Harrison Telephone company sought to remove its headquarters in Sturgis, S. D., from the store of Fred Heim to that of C. L. Van Koughnet. Mr. Heim claimed a bill against the company of $90, and refused to alow the removal of the switchboard. The company got it while he was at breakfast and carried it off in triumph. A search warrant soon secured the instrument again. Mr. Van Koughnet refuses refuses to allow the board to be placed in his store until matters are settled with Mr. Heim, and the company apparently refuses to settle.

The Chariton (Ia.) Telephone company will extend its lines to secure connection with Des Moines.

The Nebraska Telephone company has been granted a franchise at Wayne, Neb.

The telephone exchange in Knoxville, Ia., now has over 100 instruments in use. The system is owned by local capital.

The Iowa Telephone company is preparing to extend its lines from Danbury to Onawa.

Work is being pushed on the telephone system in Rockwell City, Ia., by the Central Telephone company.

L. G. M. Fletcher has procured an injunction at Mankato, Minn., to prevent the Western Electric Telephone company from stretching wires to the detriment of his shade trees. The poles, as planted, would bring the wires through the trees in a way that would require them to be cut and slashed.

Work is progressing on a telephone line toward Coeur d'Alene, Idaho, from Missoula, Mont.

The People's Telephone company of Richland Center, Wis., and the Badger Telephone company of Baraboo, Wis., have connected with Reedsburg, Wis.

The New Ulm Telephone company of New Ulm, Minn., projects an extension to Lamberton, Minn.

The Inland Telephone company will extend its wires north from Spokane, Wash., to connect with Rossland and Republic, B. C., as well as other towns in the vicinity.

The Wisconsin Telephone company has begun work changing its system at Rhinelander, Wis., to a central office.

Telephone connection will soon be made from Fairmont, Minn., to Tenhassen and Silver Lake. Connection may be made at Worthington, Minn., with a southwestern line also.

The Northwestern Telephone Exchange company of Minneapolis held a formal opening for its new central office last week. A large number of visitors examined the plant and building and appeared greatly pleased by the completeness of the system. The company has recently increased its capital stock from $3,000,000 to $4,000,000.

Dr. Boardman is rapidly installing a telephone system in Oakes, N. D.

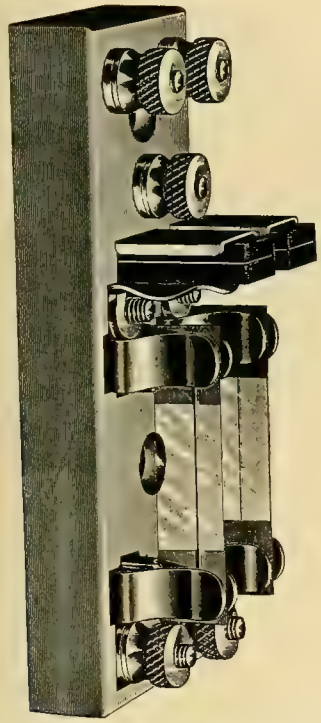
W. M. Steer of Truro, Iowa, is urging the construction of a telephone line from Truro to St. Charles.

The town of Bussey, Iowa, will vote on granting a franchise for a telephone exchange to the Knoxville Electric company.

Bids have been called for by John B. Meagher, at Mankato, Minn., for installing a telephone exchange for the Mankato Citizens' Telephone company, in the city of Mankato, Minn. Lorin Cray is president and John B. Meagher secretary of the company.

"H. C. D." Carbon and Fuse Lightning Arrester.

Operators of exchange and toll lines, and telephone users generally, do not care to take chances in matters of interruption of service, causing loss of revenue, inconvenience, waste of time and expense resultant upon improper protection of apparatus. The arrester shown in the cut herewith (which is full size) affords protection to telephones and switchboards from damage by lightning discharges, and from heavy currents, such as escape from electric-light and power circuits. Severe tests under all conditions have demonstrated its efficiency. It is compact, and is claimed to be the only combined fuse and carbon arrester with binding-posts properly arranged for convenient connection both to terminals of line and instruments, whether used singly for the protection of a telephone mounted on strips for use in connection with a switchboard, or for use in connection with combined lightning arrester, distributing and change board. The fuse links are held in position by metallic clips and can be easily and quickly removed and replaced. Spark-gap carbons are placed at right angles to the base, thus conserving space. They are held firmly in fixed position and cannot slide out of place so as to make connection, producing short-circuit, and are readily removable for examination. The arrangement of insulation between the plates is such that dust and dirt cannot form short-circuit. The metal parts are mounted on a substantial porcelain base. All parts are indestructible with the exception of the fuse links, and the cost of replacing them when burnt out is merely nominal. The carbon lightning arrester used alone does not afford



"H. C. D." CARBON AND FUSE LIGHTNING ARRESTER.

proper protection to telephones or switchboards from damage by electric currents, nor does a fuse arrester used alone. The combination of these two types must be employed to secure such immunity.

The arrester described was designed by General Superintendent H. C. Dodge of the Western Telephone Construction company of Chicago.

Williams Magneto Bell.

The accompanying illustrations show the special features of the magneto bell that is being manufactured by the Williams Electric company, Cleveland, Ohio. Fig. 1 is an illustration of the generator, showing a full front view. The magnets are fastened to the pole-pieces by brass bolts, and the arrangement is such that there is no space between the central and the outer magnets, thus utilizing all the space on the pole-pieces that is radially adjacent to the armature. The magnetic field is composed of three powerful horseshoe magnets which are three-eighths of an inch in thickness and 1¼ inches in width, and are highly polished and nickel-plated.

There is also a very perfect and ingenious method of taking the magnetism from the permanent magnets, and distributing it uniformly around the cylindrical surface of the pole-pieces, by means of contact plates, as illustrated in Fig. 2. Each contact plate has two ears turned inwardly to hold it in position on the pole-piece, and has, also, four ears turned outwardly to hold the permanent magnets rigidly in their proper position on the generator. Three portions of each contact plate are left flat or straight, so as to make a good contact surface on the permanent magnets, and two portions are formed so as to make curves coincident with the outside curvature of the pole-pieces. This arrangement not only gives perfect contact between the permanent magnets and the pole-pieces, but also takes the magnetism from the permanent magnets at or about a horizontal line bisecting the armature circle. The advantage thus gained is that instead of short-circuiting the permanent magnets by allowing the pole pieces to make contact at a higher point, a much longer length of permanent magnetism is utilized to drive the magnetism through the armature, instead of being given up entirely to the one purpose of making contacts. In this way it is also claimed that a better contact is obtained than in the old way, and at the same time a greater effective length of permanent magnets.

The end plates which hold the shaft bearings are punched from heavy brass, and have riveted into them very long brass bearings, which is a very

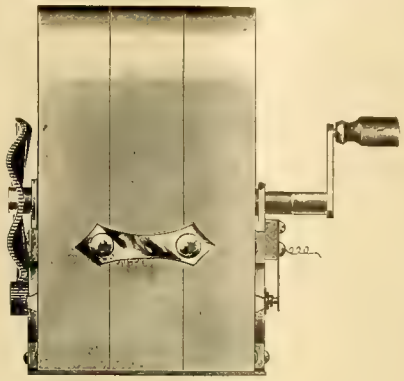


Fig. 1. Generator.

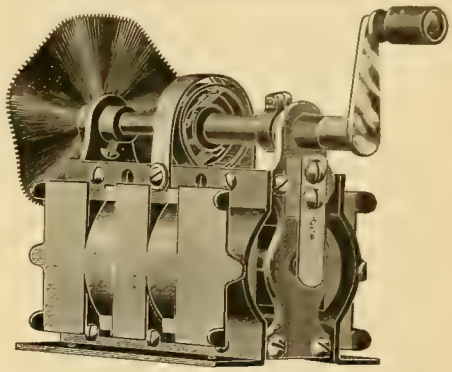


Fig. 2. Shunt and Contact Piece.

WILLIAMS MAGNETO BELL.

important feature towards making the machine run quietly for a long period of time. These end plates are practically self-centering, and the armature can be shifted and held centrally in the curvature of the pole-pieces, so as to prevent the armature wings from striking. This feature is especially important when repairs on the generator are to be made, for one is enabled to take the machine apart, repair the winding and reassemble it without special tools or appliances and with but little trouble.

This machine is equipped with a very reliable clutch form of automatic shunt or cut-out, which by its reason of simplicity of construction is not liable to get out of order.

The driving gear, which embodies an entirely new principle in gearing, is of model construction, and is placed on the left-hand side of the generator so as to avoid unequal wear on the gear bearings, caused by turning the crank. This feature entirely obviates the disagreeable noise caused by the unequal wear of the gear bearings, due to operating the crank. With this construction, the proper center distance between the shaft gear is maintained indefinitely.

The gear is made from a brass punching, which is radially corrugated, the object being to provide a driving gear that will distribute its tooth surface over the surface of the pinion in an absolutely uniform manner, entirely doing away with the noise and the short life of the old-style of disk gear. This gear, it is claimed, will not only last longer but will also run quieter during its life than will a wide-face cast-cut gear. Owing to the exact equality of the tooth surface of both the gear and pinion, the wear on each of them will be precisely the

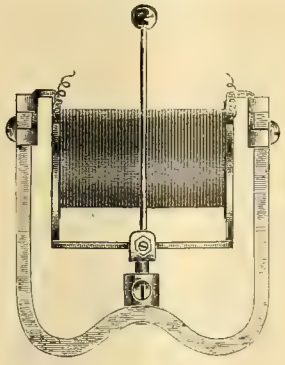


Fig. 3 Ringer.

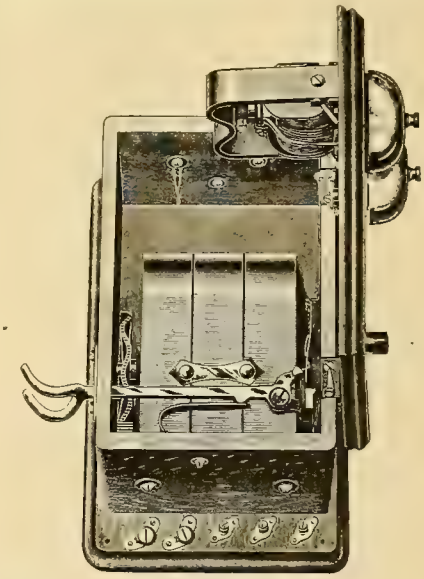


Fig. 4. Complete Bell.

WILLIAMS MAGNETO BELL.

same. This novel feature produces an exactly uniform rate of wear on all of the surface of all of the teeth on both the gear and pinion. The effect of wearing at the same rate will maintain to a greater extent the proper curves of the teeth of both the generator and pinion, causing them to roll one upon the other, instead of sliding and grating, as would be the case with the wide-faced gear, whose companion pinion wears more rapidly than the gear. The pinion is attached to the armature shaft by means of a key and machine screw, and can be instantly taken off and replaced without having to be driven off or on, as is the case of many forms of generators heretofore constructed. This little feature is of great convenience when repairs are necesasry.

The resulting wave of current of the generator, due to the peculiar construction of the pole-pieces, approaches very closely the sinusoidal form, and is very useful in transmitting signals over long leaky lines having a high coefficient of self-induction or static capacity.

The ringer, as will be seen from the cut (Fig. 3), is a decidely new departure from all preconceived methods of electrical construction in this line. It has but a single core, which is parallel with the vibrating armature. The core heads or end pieces are formed of Swedish iron, and are swaged onto the core under an enormous pressure which practically welds the end pieces to the core, forming a very perfect magnetic joint. There are no screws used to secure the core, therefore no possibility of deterioration of the electro-magnetic circuit due to effect of rusty joints and loose screws. The permanent magnet of the ringer is of the consequent pole type, which has the armature suspended from the central and consequent pole. It strikes a very hard and stiff blow to the gongs in perfect unison with the generator pulsations, irrespective of the speed of the generator. This is a very valuable feature when it comes to toll-line signaling, where sharp, clear and distinct tones are necessary. The core being situated longitudinally between the end poles of the permanent magnet, it is constantly subjected to a magnetic stress, which accounts for the delicate responsiveness of this ringer to extreme weak currents.

The general appearance of the complete bell is shown in Fig. 4. The long lever-gravity switch hook, and Craig silver contact pieces firmly attached to a hard-rubber block are mounted in the bell box in such a way as to make the switch hook entirely self-contained.

The cabinet work is wired throughout with tinned copper wire, resting between tinned spring washers, secured by screws entering the binding posts, thus forming spring contacts. All other contacts are soldered. The receiver cord binding-posts, which are located on the lower left-hand corner of the base of the instrument, are very unique in design. They are formed in such a way as to comprise a lock for the receiver cord tip that will hold it like a vise, and at the same time hold it in position with a firm but spring pressure and prevent it from working loose and dropping out of the binding-post.

In the design of this bell every point in the construction of magneto bells has been carefully considered, and every defect developed in existing forms has been studiously avoided or ingeniously remedied.

These machines are wound with the best quality of insulated copper wire, to ring through any specified resistance, from the standard of 10,000 ohms up to 150,000 ohms.

WAR NEWS.

[Continued from page 77.]

Cable Cutting Near Santiago—The crew of the cable steamer Adria, which arrived at Key West a week ago, had an interesting experience during her last trip. She left Key West on May 29th on a cable-cutting expedition, having on board Lieut.-Col. Allen of the United States Signal Corps, Capt. M. L. Hellings, Lieuts. Jones and Shepard, and E. H. Strickland. On June 1st she was at Santiago, and on June 5th began her attempt to cut the Spaniards off from communication with the rest of the world. Those who arrived on the Adria say that the lines from Santiago to Kingston were attacked first, and one cable was cut. The day after the marines landed in Guantanamo Bay the Adria went there to re-establish communication with Mole St. Nicolas for the French line, which touches Cuba at that point, and passes from there to Santiago. Shells from the Marblehead had wrecked the cable office, destroying the switchboard. Shortly before the St. Louis had cut the lines well out to sea. Capt. Goodrich had given the Adria a chart showing the point where the cable was cut, and this proved wrong and rendered a test necessary. As the men began the work of repairing the shore end near the cable house they were driven away by the fire of the Spaniards on the bluff across the harbor. They returned next day and in safety made the necessary test and prepared a switchboard. A few days later the Adria spliced the cable where the St. Louis had cut it, and Guantanamo was in direct communication with Mole St. Nicolas. Her next task was to cut the line near Aguadores and change the end to Siboney, making connection with the field line to Shafter's headquarters within a day or so after his army had landed. The French company objected to this proceedings, and notified our government that it would not be allowed to use the lines after July 9th. So the Adria laid a cable from Guantanamo to Baiquiri, and had a land line thence to Siboney. The experts who are on the Adria are positive that Havana is now cut off from all telegraphic communication with Central American ports since our possession of Santiago.

Miscellaneous Notes.—The work of clearing harbors of submarine mines is progressing, but there is yet much work to be done. Great care is required in the removal of these destructive agents, owing to the danger from accidental contact with damaged mines.

Precautions continue to be taken to defend the threatened Spanish ports, and all the buoys and beacons have been removed from the Bay of Cadiz and the harbors of the islands of Majorca, Minorca and Ivizia of the Balearic group.

The Spanish government has ordered all the lights at or near St. Sebastian, which is a fortified city situated on a small peninsula in the Bay of Biscay, to be extinguished, in view of the possibility of an American attack.

Wounded soldiers at the Marine hospital, Stapleton, S. I., and the Long Island College hospital, are treated to trolley rides when they regain their strength sufficiently to make a trip.

Dr. Woods of the Naval Hospital has had several electric fans placed in the wards. He believes this will make the men more comfortable.

John C. Holland, inventor of the Holland submarine torpedo boat Plunger, now nearing completion at the Columbian Iron Works, Baltimore, is inspecting the work and directing its completion. Superintendent Scott of the iron works said: "The Plunger is without doubt the most complicated vessel afloat, and as her mission is to go beneath as well as on the water, she must be thoroughly tested before she takes her first dive. Any mistake or shortcoming then would be fatal. For that reason she is undergoing a most extensive and exhaustive series of tests. She may not be ready for a trial trip for several months yet. We are now testing and perfecting her battery system, so that her electrical apparatus will be in perfect order when she is ready for her first trip."

An independent telephone manager is reported as saying that "people probably do not know that the war tax falls more heavily upon the independent telephone company than upon the Bell concern, but that is a fact. The law puts a one-cent tax upon each message costing 15 cents or more. In the case of many independent companies no message costs more than 25 cents, because the company and its branches do business only in restricted territory. The Bell company handles messages running anywhere from 10 cents up to that number of dollars, but they pay only the one cent, no matter how much the messages to New York or Boston may net them."

A request has just been received from Captain Frank S. De Ronde of Company F, 2d N. J. V. I., Camp "Cuba Libre," Jacksonville, Fla., for the Western Electrician. Captain De Ronde, although busy with military matters, pays this paper the high compliment of wishing to have it at camp, to quote his own words, "so as not to lose track of business entirely."

Robert Parrott of Rochester has passed the examination for naval electricians, and has been assigned to duty on the cruiser Chicago, which has just been refitted for active service at the Brooklyn navy yard, and is now ready for commission.

Narrow-gauge Railway Motor.

The operation of a narrow-gauge road demands a railway motor occupying a more restricted space than the motor built for standard-gauge roads, while giving the same power. The General Electric company has introduced one type of narrow-gauge motor known as the GE-58, which resembles in outer appearance the standard-gauge motor and has an output of 37 horse power based on the standard General Electric rating, namely, a maximum rise of 75 degrees centigrade in the temperature of the windings after a run of one hour at rated load, the temperature of the surrounding air not exceeding 25 degrees. This motor is built for comparatively heavy service, and is especially desirable in cases of combined city and interurban service with moderately high speeds and heavy traffic. While designed for a minimum gauge of one meter (39¼ inches), the GE-58 may be used with wider gauge roads.

The magnet frame is made of soft steel of high magnetic permeability, cast in two bowl-shaped halves. The frame is divided in a horizontal plane, and the two parts, when bolted together, completely enclose and protect the armature, commutator, brush-holders and field coils. Extension pieces are cast on the top at each end, and extend over and partly enclose the car axle. To the under side of these extension pieces are bolted the axle-bearing caps bored out to support and enclose the axle linings. The armature supports are made by bolting the bearing caps to the under side of the top frame at each end and boring them to receive the linings. The bottom frame is secured to the top frame by bolts so hinged that when the rear bolts are removed the lower frame will swing down, exposing the armature and field coils for inspection and cleaning. In this position the bottom of the field coils may be easily taken out, while by removing the armature caps and the bottom half of the gear case, the armature and top field coils may be easily removed.

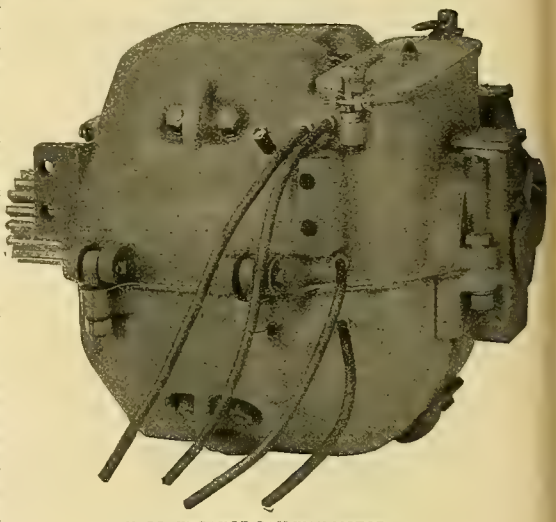
A large opening is provided in the top frame just over the commutator, through which the commutator, brush-holders and brushes can be inspected, and worn-out brushes replaced. Through the same opening it is possible to remove the brush-holder yoke and brush-holder bodies. A malleable-iron cover is securely held in place over this opening, by an adjustable cam-locking device and is easily and quickly removed. A hand-hole fitted with a gasket and cover plate is provided in the bottom frame directly under the commutator, permitting easy access to the bottom of the motor for inspection and removal of foreign substances.

Appreciating the fact that the renewal of linings is frequently the principal item of maintenance cost of a motor, particularly when designed within the limitations of narrow gauge, much attention has been given to the design of the linings and the bearings. The armature-bearing linings are made of machined cast-iron with 3-16 inch babbit metal swaged hard and bored to the proper size to fit the shaft. The bearing of the commutator end is 2 5-8 inches by 6 5-16 inches, and on the pinion end 3 inches by 7 7-8 inches. The supports for the linings are constructed on the outboard plan, making the bearings easily accessible and preventing oil or grease from working into the motor frame. The support for the upper half of the armature-shaft lining is cast as a part of the upper half of the frame and is provided with a large-cored recess between the inner end of the lining and motor frame. This space is utilized for a thrust collar so designed that its outer edge acts as an oil guard and turns in the recess between the motor frame and the bearings. The support for the lower half of the lining is a cap bolted to the upper frame in such a way as not to enclose the lower half of the oil guard, thus allowing free egress for the lubricant after it has passed through the bearing. The axle-bearing linings are similar to the armature-bearing linings and are eight inches in length and of the required diameter to fit the car axle. The upper supports for these linings are cast with the upper frame; the lower supports are caps bolted to the upper support. All bearings on the motor are provided with grease boxes and oil cellars of sufficient capacity for thorough lubrication. The grease boxes are cast with the upper frame and are covered with flanged lids held down by springs to exclude the dust and dirt. Oil cellars of ample capacity are provided in the bearing caps. The oil is fed by felt wicks or wipers, which come in contact with the shaft through holes cut in the linings.

The motor has four field coils, two in each frame, placed at an angle of 45 degrees from the split and held in place by pressed steel flanges, or spool holders, clamped by projections on the laminated pole pieces. The pole pieces are held in place by through bolts with nuts on the outside of the frame, the coils being placed in position when the pole pieces are bolted to the frame. The field coils are wound with round wire insulated with asbestos, and are substantially insulated over all with wrappings of varnished cloth and tape. The insulation between field coils and motor frame is tested by 5,000 volts alternating—sufficient to thoroughly prove the quality of the insulation. The field coil leads are brought out through the frame in a convenient manner for connecting to the car wiring, and it is not necessary to disconnect any leads inside of the motor frame when dropping the lower half for cleaning.

The armature is of the well-known iron-clad type and is 14½ inches in diameter with a spread of 6½ inches. The core is built up of well annealed laminations and is assembled directly on the shaft. There are 33 slots and each slot contains three coils, collected together and insulated so as to form one triple coil. Hence there are 33 triple coils connected with 99 commutator bars. A small number of coils is of especial advantage when an armature has to be repaired, and the method of forming the coils into groups of three admits of substantial insulation of high quality. The insulation of the coils consists of specially prepared tape and cloth, which has high insulating qualities and is impervious to moisture. When the coils are in place on the armature core they will withstand, without injury, a high potential test of 2,500 volts between the windings and the core. The terminals of each coil are brought directly into the commutator segments and soldered so as to properly connect the armature coils, and at the same time form the connections between the armature windings and the commutator. The end windings are effectually protected from mechanical injury and carbon dust by the metal core heads and by a canvas dressing. The coils are held in place in the slots and on the ends by tinned-steel wire bands, held together by clips and securely soldered.

The commutator is 10 inches in diameter. Its segments are 4⅜ inches long with a wearing depth of one inch and are insulated from the shell by cone clamping insulations of the best quality of pressed mica. The segments are of the highest grade drawn copper of uniform hardness, and are slotted at the back for armature leads. The mica between



NARROW-GAUGE RAILWAY MOTOR.

the segments is of a somewhat softer quality than that used in the clamping insulations, to insure an even wear with the copper segments. The completed commutator is tested by 5,000 volts between segments and shell and 500 volts between adjacent segments. Particular attention has been given to the matter of commutation, and under normal conditions the commutator will run with practically no sparking.

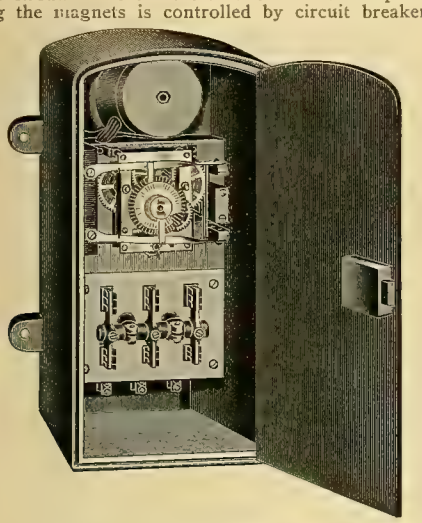
The brush-holders are of cast-brass and each holder is constructed to receive two carbon brushes. The brushes are 1⅜ inches by 2¼ inches by one-half inch. They slide in finished ways and are held in place against the commutator by independent pressure fingers, which give a uniform pressure to the brushes throughout their entire working range. The brush-holders are clamped to a hard-wood yoke, carefully treated with a moisture-proof insulating compound. The brush-holder yoke is bolted to the top magnet frame, and is so arranged that it may be removed through the opening in the frame over the commutator. All the leads from the motor to the car body are brought out through the rubber-bushed holes in the magnet frame at the front of the motor, thus facilitating wiring of the car.

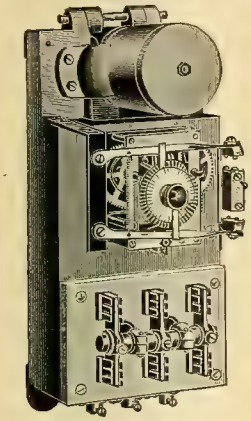
These motors are adapted to nose, yoke or side-bar suspension. The yoke suspension is especially recommended, as the weight of the motor is carried on springs placed upon the side of the truck frame. Lugs are cast on the upper magnet frame, to which the suspension bar is bolted; the lower half may, therefore, be swung down into the pit without disturbing the upper half, which remains suspended from the axle and yoke. When the motor is mounted on 33-inch wheels, the clearance between the bottom of the motor frame and the top of the rails is 4¼ inches, the clearance between the bottom of the gear case and the top of the track is 4¾ inches. The motor without gear or gear case weighs 1,865 pounds, and complete, with both gear and gear case, weighs 2,150 pounds.

The New Orleans and Western Railroad company is considering the idea of building an electric railroad line from the suburbs of New Orleans to Port Chalmette. R. B. Fowler, at Port Chalmette, La., will be the superintendent of the road.

Automatic Electric Time Switch.

The demand for reliable cut-in and cut-out electric time switch is met by the Cleveland Electric company, which has designed and perfected a switch of this kind for the purpose of automatically closing and opening electric circuits, controlling any given number of lights or quantity of current on power circuits from 100 to 200 amperes. The general design is shown in the cuts herewith presented which show the features of construction and general appearance of the switch, which consists of a two or three-pole double-break knife-blade switch, operated by an electromagnet in conjunction with a lever and spring, whereby an instantaneous break or opening and closing of the circuit is obtained, the operating current being controlled by an eight-day clock movement. Two disks or dials are mounted on the hour stem of the clock movement, one to control the turning-on and the other the turning-off movement, and are held in position by means of an adjustable thumb nut. These disks are divided into 24 sections, representing hours. Each dial has a zero point notched in the periphery, which allows a lever or contact arm to drop at the zero point (neither pins nor pegs being used about the dials for the purpose of making contact, and in consequence there is nothing to become loose and burn out in a short period of time). When the time for switching on arrives the contact arm closes the circuit through one of the magnet coils, which, acting on the lever and spring referred to, closes the knife switch, thereby completing the circuit. This action of the magnet in turn opens the knife switch when the time arrives for cutting out the lights or supply of current to the circuit. The current that is utilized in operating the magnets is controlled by circuit breakers





FIGS. 1 AND 2.—AUTOMATIC ELECTRIC TIME SWITCH.

which prevent a constant flow of current passing through the magnet coils; therefore no current is consumed in throwing the switch except when the time arrives for switching on and off, and then only for a second. This makes the action of the switch positive and prevents any injury to the magnets from an excessive flow of current.

The switch will accomplish a saving that will accrue to the consumer of current on the meter basis, and likewise to the producer or illuminating companies in the reduction of labor necessary for switching, aside from the saving made in the consumption of current gained in having all street arc lights switched on at the same time. It will operate successfully on direct-current two or three-wire systems. These switches are built to fulfill certain requirements imposed upon them in the company's factory, and are not allowed to leave the factory unless they are found to actually meet these requirements.

Ohio Desk Lamp.

The illustration shows the 14 candle power hanging lamp, operated by eight Fuller batteries, which is placed on the market by the Ohio Electric Works of Cleveland. For the desk, library, parlor, dining-room, hall or chamber it is efficient and economical. Eight Fuller batteries are used, and no trouble is experienced, as they require no attention after setting up, and the light can be turned on and off at will. The lamp is said to take one ampere at 14 volts.

Killed by Lightning.

John Suttner, 15 years old, and Omer White, 16 years old, were killed by a bolt of lightning that struck the state pier, opposite the foot of Genesee street, Buffalo during a recent storm. The boys were running along the pier when the bolt struck them. They were fully 40 feet apart. Suttner's brother Frank was within a foot of him and was not seriously hurt, while Frank Glaser was immediately behind White when the latter was killed. Glaser was but momentarily stunned. Suttner's body was lifted high in the air, while White was carried nearly 50 feet. The bolt that killed the two boys caused a slight shock to four or five others who were swimming on the opposite side of the basin. It also shocked other boys along the pier. That it should kill both boys who were over 40 feet apart, should not kill the other boys who were beside them, should toss one of its victims many feet away and lift the other high in the air, are things hard to explain. Many stones were scattered along the pier. The stones that form the level part of the pier were not disturbed. They were connected by iron brackets, and this fact, it is thought, may have had some influence upon the action of the elements.

Motive Power of New York Street Railways.

H. G. Prout, editor of the Railroad Gazette, has contributed an interesting article to the New York Times on the possible or probable motive power to be used on the passenger lines in New York. He says:

"It is well to begin with the elevated railroads, and it must not be taken for granted that steam will there soon give way to any other motive power. Perhaps it will and perhaps it will not; but there are sound mechanical and commercial reasons for hesitation. Electric motive power on the elevated railroads would offer certain advantages to the public and to the owners of that property. It is cleaner than the steam locomotive. The coal dust blown out of the stack at starting and while getting up speed is an annoyance to get rid of which it would be worth while to spend some hundreds of thousands of dollars, but it would not be worth while to spend six or seven million dollars.

"With electric motors the traffic could be handled somewhat faster. This is not because it is electricity, but for certain simple mechanical reasons. A lame mule could propel a car at 100 miles an hour if the car were light enough, and with proper gearing between the mule and the car. Speed is a question of power, but the power that a locomotive can exert is limited by its weight, and the weight of a locomotive is limited by the structure which carries it. If electric motors were used on the elevated railroads the weight of these motors could be distributed over eight wheels, or 10 wheels, or 12 wheels, or more or less, and more adhesion weight could be used without overtaxing the structure, and consequently speed could be got up quicker, or a higher maximum speed could be reached.

"For the same reason heavier trains could be hauled, and if seven cars were run instead of five in each train, 40 per cent. more passengers could be handled in a unit of time, regardless of the interval between trains or of their speed.

"Whether or not electricity would save anything in cost of operation in this special case is a matter of debate among experts. The steam locomotives now used on the Manhattan Elevated are efficient machines, and, taken all in all, the elevated railroads of New York give the people a service which in the combination of the magnitude of the traffic, the safety with which it is carried, the speed, the regularity, the comfort and the economy is unparalleled in the history of transportation; it is probable that no other instance can be found in which these elements are combined on such a scale. But, further, the service is possibly the most intense in the world, and an interruption causes inconvenience to thousands of people. Now, with the steam locomotive each train is a self-contained unit, and an accident to that train does not necessarily interrupt the traffic over the whole line or interrupt it for a considerable time, but with electric working the whole system is on one string. A failure in the power house or in the conductors stops everything. In practice this difficulty is not as serious as it is in theory, but the danger is present, and the prudent engineer is bound to think of it when he decides between steam and electricity.

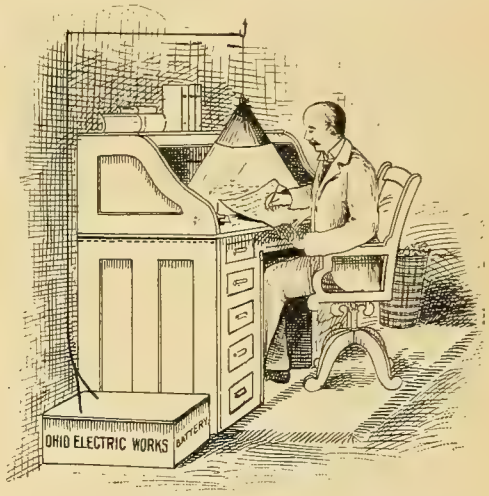
"So with the elevated railroads it is a proper question if the economy of working and the increase of travel which would result from the use of electricity would pay for the increase in interest account and for some mechanical disadvantages, and therefore there is balancing of advantages and disadvantages, and it is dangerous to predict when the scale will tip toward electricity, although probably it will do so sooner or later.

"On the surface roads of New York the only question has been between the cable and electricity. When the cable lines now running were put in there was no such question, because the underground trolley was a mere study on paper and the overhead trolley was not permitted—most fortunately for New York. But now a cable line will probably never again be built in an American city, although such lines are still building in some other parts of the world. The electric system, even with the interest account on the cost of the underground trolley, is cheaper to work and maintain than the cable, and it has greater flexibility. For instance, the maximum speed of any one car is the maximum speed at which the cable is run, and a car which has fallen behind its schedule can never catch up; but in electric working there is no such limit, and the clever motorman can take advantage of clear space ahead of him to make up the seconds or fractions of seconds which he may have lost.

"Here in New York there is an especial reason for abandoning the cable and working all the surface lines by the underground trolley. The complete carrying out of the comprehensive and far-sighted scheme now developing requires uniformity in the motive power. The ultimate purpose of the Metropolitan Street Railway company is to be able to change the routes of cars during the day according to the travel. For instance, in certain morning hours the mass of travel from any one region in the upper part of the city is destined for lower Broadway and that neighborhood. Later in the day for some hours the mass of the movement for the same uptown region would go into the shopping district. Still later it would go into the region where the theaters are most numerous. This is an example which might be paralleled by some of the crosstown movements. By routing the cars according to the current of greatest travel the maximum public accommodation can be given. This conception is always before the minds of the responsible officers of the company; as their plans slowly develop, as more streets are trolleyed, as for example Eighth avenue and Sixth avenue, this kind of special service for the better accommodation of the public can be organized. Obviously, if all the surface lines were under one control this intelligent adjustment of car movement to the actual currents of travel could be carried still further, and that is the logical development of the situation. The control by one company of all the surface railroads, elevated and underground railroads (if any underground line is ever built) would be ideal, and it is not difficult to show that the maximum of public service with the minimum cost to the public could be secured by putting all the city railroads into the hands of one 'beneficent monopoly.'

"But this harmonious development, even if it never goes to the ideal climax here suggested, demands one kind of motive power, and hence, considering the 'present state of the art,' as the patent lawyers say, we may apprehend that the underground trolley will be extended everywhere where mechanical traction can be used in the city of New York.

"But the whole story is not yet told, and perhaps the present state of the art is to some extent only a temporary state. The interest cost and the labor charges of the fixed plant for the underground trolley are, roughly speaking, as much on a route where there is a car service every five minutes as where cars must be run every 40 seconds. There are routes of travel, however, especially on crosstown lines, where mechanical traction is desirable for the better public service and to stimulate travel, but where the underground trolley would perhaps not pay, or, at any rate, would not pay until there has been a considerable growth of passenger movement on such lines. This is still more true of a great many towns smaller than New York city. So it is desirable to have a set of independent, self-contained motor cars that can run on horse car



OHIO DESK LAMP.

tracks as they now exist, and save the cost of the underground trolley construction. Still further, such independent, self-contained motor cars could be diverted to any route, and interpolated between electric or cable cars, and so aid in the development of the logical routing of cars according to the demand of the hour.

"But for such service the steam motor is out of the question, for reasons which need not be developed here. The same is true in the present state of the art of the electric storage-battery motor. The same is probably true of the hot-water motor. And so we are brought around to compressed air. There are reasons to suppose that a compressed-air engine will do street-railroad service with acceptable speed, reliability and economy. We cannot admit that this is demonstrated yet, but there are reasons to suppose that it is true. There is considerable accumulated experience in mines, on cotton wharves and on experimental surface lines which justifies such a hope at least, and compressed-air motors have been improved in design since that experience was begun. There has been no important experiment with the latest designs of such motors, and compressed air has never been put to the actual work of hauling city street cars in a large and responsible way. Such an experiment will soon begin in New York city. The Metropolitan Street Railway company will, within a few months, have a line of compressed-air motors in service between the ferry at West Twenty-third street and that at East Thirty-fourth street, by way of Twenty-eigh.h and Twenty-ninth streets. It will also have a service by compressed air between the West Twenty-third street ferry and the Grand Central Station. This will be a thoroughly modern and scientific equipment, and here an actual demonstration will be carried out on a large scale. This demonstration will show whether compressed air can fill the requirements of speed, power, reliability and economy as well as electricity or steam can do in like situations. The social and financial results of that demonstration may be very important; to an intelligent public they may be deeply interesting; and so it is worth while to keep close watch of them."

Japanese Visitor at Niagara.

Among the recent foreign visitors to Niagara Falls was I. Kutaro Tara of Hiroshima, Japan. Mr. Tara is an educated Japanese gentleman, young, well built, slender and graceful. He was much pleased with the power development at Niagara and in an interview said:

"This is my first visit to this country. I have been in most other lands, but never here. Oh, this is one great country. It is very like Japan, but, oh, so much bigger. Everything, buildings, horses, cars, everything is on one large scale here. I come to San Francisco first. It is a large city. I am much pleased with it. I reach Chicago. It is a greater city. Then by and by I get to New York. Ah, there is the greatest city. But very much hurry I did see there also. Everybody is in a hurry. He eats fast, he thinks fast and he walks fast. But he knows how to make money. I had a very good time in New York, and I think I shall go back once before I return myself to Japan.

"I live in Hiroshima. It is 300 miles from Tokyo. We have the electric cars very much the same as you. We call them Hito-koro-shi-kikui, which means the 'killing machines.' We did so because the motorman was careless at first and ran over many people. He lost control."

The newspaper man said that such things had happened in this country also.

"We Japanese are learning to do things like the Americans. We like you much. You know how to do better than other people. We wear your clothes, we ride in your cars and we fight in your ships. Our newspapers we make as much like yours as we can. We shall be beside you when you need us. We are the Yankees of the East. You call us so. We are proud."

It was suggested that he would like Boston better than New York, and he said: "Perhaps; but you, my friend, will pardon me if I think I shall not."

American Electro-therapeutic Association.

The eighth annual meeting of the American Electro-therapeutic association will be held on Tuesday, Wednesday and Thursday, September 13th, 14th and 15th, in the rooms of the society of Natural Sciences in the public library, Lafayette Square, Buffalo. A programme of exceptional interest is assured. There will be an exhibition of electrical apparatus for diagnostic, therapeutic and radiographic work. Entertainment has been provided, including tally-ho coach drives about the city daily, a public reception on Tuesday night, an excursion down Niagara River and reception at Island Club, Grand Island, and other receptions. The committee of arrangements at Buffalo comprises Drs. Ernest Wende, William W. Potter, Roswell Park, Herman E. Hayd and H. R. Hopkins. Charles R. Huntley and Newcomb Carlton will represent the electrical fraternity.

A series of 10-minute discussions on electro-therapy, of special interest to the general practitioner, including effect of electricity on tissue metabolism and electro-diagnosis, will be a feature. Many papers have been promised by eminent specialists, both of this country and abroad.

Proposed Submarine Trolley Line.

The contemplated reorganization of the Hudson Tunnel Railroad company includes the building of a trolley line, it is said, between New York and New Jersey; hence the title given the project. On July 26th former United States District Attorney Henry S. White, representing the Farmers' Loan and Trust company of New York, and John Henry Kendall Broughton of London, trustees for the bondholders of the Hudson Tunnel Railway company, made application to Chancellor McGill in Jersey City for an order to sell the company's property, consisting of the unfinished Hudson River tunnel. The application was made in view of the foreclosure proceedings on a mortgage for nearly $4,000,000 held by the trust company. The work of constructing the tunnel has dragged along for many years, the management has changed hands a number of times, the work has been suspended for intervals of a year or two and the project has met with apparently insurmountable obstacles. If Chancellor McGill authorizes the sale, it is proposed to reorganize the company and push the tunnel to completion. It is said that only 250 feet remains to be finished. The tunnel is designed to extend from Fifteenth street, Jersey City, to Morton street, New York. It is understood that the new scheme includes a trolley line to be operated in the tunnel, which will carry passengers between the cities in three minutes.

CORRESPONDENCE.

New York Notes.

New York, July 30.—Improved transportation facilities are demanded in many parts of this city outside of the downtown territory, and in recognition of this need permission has been given by the railroad commissioners for the construction of three railroads, to be operated by electricity. The companies authorized to construct these lines are the Kingsbridge Railway company, which will operate a road from Manhattan street to Yonkers, over the boulevard and Kingsbridge road; the North End Street Railway company, to operate a road from One-hundred-and-thirtieth street and the boulevard, over the boulevard and the Kingsbridge road to One-hundred-and-forty-fifth street, and over that street to the Harlem River, and the Fort George and Eleventh Avenue Railroad company, to operate a road from the junction of the Kingsbridge road and the boulevard, over the boulevard to One-hundred-and-seventy-fifth street. The first two permissions were granted on the stipulation by the two companies that they would use the same tracks on that part of the boulevard where the routes are coincident.

The highway commissioners of Rye have almost completed parceling out to the Port Chester Electric company the boulevards and streets it now requires to extend its trolley lines from Port Chester to Rye Beach and Mamaroneck. Cars are already running from the Connecticut line through Port Chester to a point near the Apawamis Club, in Rye Village, but, pending a controversy with the commissioners regarding fares, construction on the proposed extensions has been at a standstill.

The routes chosen by the company are the least objectionable it could find, yet, to reach the destinations desired, it will be necessary, according to the plans, to pass scores of the most beautiful homes in Rye and cut up some of its most beautiful driveways. The owners of this property are very much exercised over the prospect of the cars hurrying their loads to the beach and bringing them back at night, especially on Sundays, yet there seems to be no doubt that the road will be built.

The Kinderhook Power and Light company of Rensselaer County, to furnish electricity for heating and lighting purposes in the cities and villages of Rensselaer County, has been incorporated with a capital of $50,000. The directors for the first year are James Purcell of Valatie; James R. Hughes, James Hogan and John Ritz of Stuyvesant Falls and William D. Barnes of Brainerd.

Conflicting ideas seem to prevail in the courts of New York and New Jersey. In a case against the Jersey City Consolidated Traction company some time ago, a father recovered a verdict of $5,000 against the defendant for negligently causing the death of his five-year-old child. Now, this verdict has been set aside by Justice Gummere of the New Jersey Supreme Court, who takes the ground that children are usually an expense rather than a pecuniary benefit to their parents, and argues that if the father of the child who was killed could reasonably regard that child's life as worth $5,000, a family of 10 children would represent a beneficial value of $50,000 to the father. In this state the courts hold that in estimating the value of a child's life to his next of kin, the jury is not bound to consider only the services he might render up to the age of 21. Our courts have also repeatedly held that it would be error to instruct the jury that only nominal damages can be recovered in such a case, as the child might grow up to contribute generously to the pecuniary welfare of the parents.

Mary A. Wright of New Rochelle, through her attorney, R. McKinlay Power, obtained an order last week from Justice Keogh restraining the West Chester Electric company from laying its trolley tracks on Pelham road. No sooner had the order been served than the contractors roused several hundred Italians from their shanties and set them to building the track in the rain. The work was kept up all night, and the tracks now occupy the territory in dispute. Mrs. Wright says that she will apply to the courts for an injunction to restrain the company from operating its cars. M. A.

Canadian Intelligence.

Ottawa, July 30.—A plebiscite vote will be submitted to the ratepayers of the Canadian capital upon the question of a Sunday electric-car service in January next. No cars are now allowed to run on Sunday in Ottawa, and it is said that not only the employes of the road but the company also are opposed to the proposition. The vote, it is believed, however, will be largely in favor of a Sunday service.

A proposal is to be made to the City Council of St. John, N. B., to secure legislation to take over the property, privileges and franchises of the St. John Electric Street Railway company, to be conducted by the city in the interests of the ratepayers.

The agreement between the city of Brantford, Ont., and the Brantford Electric and Operating company for street lighting has been signed, the franchise being for 10 years. The company will expend immediately about $10,000 on additional plant.

The project to produce power by the construction of a channel from the Welland to the Jordan rivers, Ont., has again been revived. William Pearson, C. E., of Oswego, is said to have pronounced the scheme feasible from an engineering standpoint. The question of disposing of the power will now be tested.

The Canadian Pacific Railway Telegraph company having completed its new copper wire between Ontario and the Pacific coast, is now able to give better facilities, and consequently has reduced its rates 20 per cent. from Ontario to many of its offices in British Columbia.

A very important meeting in connection with the Quebec South Shore electric has been held in Montreal. At first there was some difference of opinion as to what scheme the committee should endorse, but eventually it was decided to recommend the councils of those municipalities through which the line will pass to provide for the proposition originally made, should a sufficient guarantee be furnished to insure the early completion of the line. The discussion of the route was left over for a future meeting.

Ex-Mayor Elliott of Brantford, Ont., representing the syndicate which has undertaken the construction of the proposed new railway between Brantford and the city of Woodstock, has just been conferring with Toronto members of the syndicate respecting arrangements for an early start in building the road. D. A. Middleton, C. E., of Ottawa has just completed a survey of the road, which traverses as fine a stretch of agricultural country as is to be found in Canada, and is particularly adapted for railway construction, the average per mile of cost of construction being about 10 per cent. less than the ordinary estimate. The new line will be 26 miles in length. It is expected that active operations will commence on the first of September next. A. V. W.

Northwestern Notations.

Minneapolis, July 30.—The electric-light system at Parkersburg, Ia., is now in operation.

The electric street-railway line in Yankton, S. D., was sold for taxes recently and was bought in by the owners for $246. The taxes amounted to $400

The apparatus of the second largest electrical plant in the United States at Canyon Ferry, near Helena, Mont., has been tested and found satisfactory. Power was transmitted to two smelters and a street-car line. Mining men believe that it will revolutionize mining in the vicinity.

The car house and shops in Olympia, Wash., have been burned, with all the rolling stock.

It is reported a plan is on foot to build an electric railway between Moravia, Ia., and Iconium, and later to extend it to Griffinsville and Confidence, and south from Moravia to Centerville, making about 32 miles in all.

The British Electric Traction company of London, England, has applied for a franchise for an electric-car line in Nelson, B. C.

Work has been begun on the Neola, Ia., electric-light plant.

The electric-light company of Grundy Center, Ia., has increased the street lights to 2,000 candle power.

The first of the Twin City Rapid Transit company's personally conducted trolley tours around Minneapolis and St. Paul was successful. All the popular suburban resorts were visited. The cars used are entirely new and very handsomely fitted up.

Two Harbors, Minn., will vote on the proposition to issue $8,000 bonds for the establishment of an electric-light plant.

The council of West Superior, Wis., ordered the electric-light company to remove its poles from the streets. The company refused, as its franchise will not expire for 11 years. The council will take

bids for furnishing 50, 100, 150 and 200 arc lights of 1,200 to 2,000 candle power for a term of one, two and three years.

The council of Neenah, Wis., still refuses to grant concessions to the interurban electric line.

The electric-light plant at Mora, Minn., has been completed and put in operation.

Charles H. Lithgow of Los Angeles, Cal has been made manager of the Postal Telegraph company's office in Davenport, Ia., succeeding T. A. Bryant, who goes to Chicago.

The Citizens' Traction company's car on Ninth street, in Oshkosh, Wis., killed a horse and wrecked a wagon, the driver of which failed to hear the gong of the car and turned across the track immediately in front of the car.

The Chicago and Northwestern Railroad company is resisting the attempt of the Citizens' Traction company to cross its tracks in Oshkosh, and maintains a guard day and night, in order that the electric company will not steal a march.

D. E. Pepin, formerly superintendent of the street-railway company at Chippewa Falls, Wis., has gone to New York, where he has a position as superintendent of a line being constructed.

The interurban line between Eau Claire, Wis., and Chippewa Falls is promised to be completed by August 15. Track building is progressing from both ends.

Cresco, Ia., voted to authorize the council to contract for electric lights.

The council of Winona, Minn., has granted the street-railway company a right to change the route of the line and to make extensions.

The court has modified the order requiring employes of the Duluth Street Railway company to be in uniform in order to ride free, and they may now ride free if they wear their badges.

The council of Duluth, Minn., is considering an ordinance for the issue of $100,000 bonds for an electric-lighting plant. M. S. P.

PERSONAL.

M. E. Baird of the Eddy Electric Manufacturing company was in Chicago last week.

C. G. Y. King, mechanical engineer of the Chicago Edison company, has returned from a six weeks' trip abroad. Mr. King visited London, Liverpool, Paris, Berlin, Frankfort and Glasgow, and examined the central-station plants and principal manufacturing establishments in those cities.

ELECTRIC LIGHTING.

Fire damaged the Orange, Texas, electric-light plant recently. The loss sustained amounted to $600.

The system for electric lighting will be extended through the suburbs of Jacksonville, Fla. C. O. Patterson, superintendent, can furnish information.

The city of Winchester, Va., is making arrangements to establish the electric-lighting plant recently voted for by the citizens. It is proposed to have 70 2,000 candle power arc lights, to be operated in conjunction with the municipal pumping plant.

Shoneman Brothers, Eighth street, Philadelphia, are in the market for a return-tubular steel (dry pipe) boiler, 66 by 16 feet; also a Corliss engine of 150 horse power and an electric generator of 150 horse power at 110 volts. The machinery may be second-hand but must be in good running condition.

ELECTRIC RAILWAYS.

The Oxford Lake Railroad company at Anniston, Ala., has awarded a contract to E. J. O'Brien & Bros. to construct the proposed extension of its trolley system.

The Dallas Electric Railway company has issued bonds to the amount of $800,000, which will be used in making improvements and extensions to its trolley lines in Dallas. Channing M. Ward of Dallas has charge of the arrangements.

The New York State railroad commissioners have granted permission to the Buffalo Valley Railroad company to construct an electric line from Buffalo to Java, a distance of 26 miles. The new road is intended for freight and passenger traffic. It will pass through or near the villages of Gardenville, Elma, East Elma, Marilla, Porterville, Wales Center, Wales, Strykersville and Java.

General Passenger Agent D. I. Roberts of the Erie railroad announces that an arrangement has been perfected whereby the passenger traffic over that road to Toronto will be sent through the Niagara gorge and on the boats of the Niagara Navigation company to Toronto. In the past the Erie has run its trains to Port Dalhousie, where boat connections were made, but on July 31st this arrangement was canceled.

B. P. Holland and William H. McGrath are forming a company which will include several New England capitalists, to construct a system of electric lines in the vicinity of Dallas, Texas. Charters will be procured for the construction of lines radiating from Dallas to Fort Worth, 32 miles; to Waxahachie, 30 miles; to Terrell, 30 miles; to Denton, 30 miles; to Greenville, 30 miles, and to McKinney, 30 miles. The Waxahachie line may be extended to Corsicana, 54 miles from Dallas, and to Hillsboro, 75 miles, and the McKinney line to Sherman and Denison, 60 and 75 miles, respectively, from Dallas.

Dr. Charles Van Orden of Sacramento contemplates the operation of a road between Sacramento and Verdi, Nev., a distance of 144 miles, by electricity, power to be generated from the water stored in the shed at Summit Valley.

In Hamilton, Ont., on Wednesday, July 27th, the ratepayers decided two or three questions of considerable importance to the street railway interests of that city. One question was the municipal ownership of the road, the other as to extending the franchise for 15 years. On the question of purchase the vote was: For purchase, 264; against purchase, 2,043. For the extension of the company's franchise there were 1,658 votes in favor and 933 against.

POWER TRANSMISSION.

The setting of poles for the Jordan Narrows electric line was completed to the Old Jordan and Galena mine July 23d, and it will not be long before Bingham, Cal., and its mines will be illuminated by electricity.

As soon as practicable work will be begun on a new electrical power plant for the Dexter mine. The new power station is to be erected at a point nine miles from the mill. A measurement of the water showed that it would furnish 200 horse power. S. B. Milner is manager of the mine, says the Salt Lake Tribune.

TELEGRAPH.

The Western Union Telegraph company has secured a restraining order against the North Carolina railway commission's order of 1897, reducing the rate on 10-word messages from point to point in the state from 25 cents to 15 cents, and also against the order of July 13th reducing the rate from 25 to 24 cents, in order to make allowance for the one-cent war-tax stamp.

The Eastern Telegraph company has decided to issue at par £500,000 3½ per cent. preference stock. The money is required for additional cables to be laid from Porthcurnow to Gibraltar, from Gibraltar to Malta, and for other purposes. It is also intended to lay a triplicate cable between Malta and Alexandria, in order to improve and generally facilitate the transmission of messages to and from Egypt and the Far East.

The London Chronicle of July 26th announces a new Central African telegraph scheme, which is probably backed by Cecil Rhodes as a link from Cape Colony to Cairo, although all of the present expense will be borne by the king of the Belgians. The line will be constructed from the western shore of Lake Tanganyika to Stanley Falls. The expedition to build the line will start in about a month, and it is said that it will be headed by an American who has seen much service on the Congo.

ELECTRICAL SECURITIES.

For the quarter ended June 30th the Newburg Electric Railway company reports gross earnings $19,856, decrease $658; operating expenses, $12,347, increase, $408; net earnings, $7,509, decrease, $1,066.

It is authoritatively announced that the Chicago Edison company has sold $350,000 of its new five per cent. gold bonds on a 4½ per cent. interest basis—perhaps the lowest interest basis on which similar bonds were ever sold in a large block from first hands in this vicinity or in the country. The bonds were issued, under the provisions of the mortgage, for improvements. With this issue there are $3,325,000 of these new bonds outstanding.

The Wisconsin Inland Lakes and Chicago Railway company's first mortgage, recently filed for record, bears date of January 1, 1898, and provides for a total issue of $10,000,000 five per cent. gold bonds due January 1, 1928, interest payable January and July. The mortgage covers as a first lien all property of every sort, including right of way and the line of electric road to be built from Chicago to Rhinelander, Wis., with branches to Madison and Milwaukee and to some other points. The system is to comprise about 500 miles of road. The purpose of the bond issue is to provide funds to pay the present indebtedness of the company, to meet current expenses until such time as profits from operation are sufficient to pay them and to cover the cost of acquiring right of way, depot grounds, etc., and constructing and equipping the road. If any bonds remain unissued after these purposes are fulfilled, they are to be canceled and retired. There is no specific provision as to the method of issuing the bonds, but the company pledges that bonds will be issued only for the purposes named. The sinking-fund clause requires that, beginning 10 years after the date of the mortgage, there shall be turned over to the trustee five per cent. annually of the road's gross receipts to purchase and retire bonds.

Preliminaries have been arranged for the execution of a mortgage by the Commonwealth Electric company to secure a bond issue of $2,500,000, bearing interest at five per cent. and extending 45 years. It is expected that $2,000,000 of this sum will be issued at once. There will be reserved $150,000 to take up a like amount of underlying bonds issued by the various companies which were absorbed by the Commonwealth, and the remaining $350,000 of bonds will be issued for extensions. The mortgage will provide that after this $2,500,000 of bonds are issued, still other bonds may be issued to cover 75 per cent. of the actual cost of further extensions and improvements. The sinking-fund clause will provide that for the first five years all of the earnings of the company above fixed charges shall be put back into the property for betterments and improvements. After this first five years an amount equal to $17,000 for each $1,000,000 of bonds outstanding shall be set aside for depreciation reserve account—that is, $17,000 for each full $1,000,000 and a proportionate amount for each fraction of $1,000,000 of bonds outstanding. This depreciation reserve account will be treated by the Commonwealth company just as the like account is treated by the Chicago Edison company under its mortgage, that is, the amounts accruing under that clause of the mortgage will be used only to give permanent improvements to the plant of the company in the way of bona fide extensions. The Edison mortgage, it will be remembered, contemplates a total issue of $6,000,000 of bonds, and the ultimate charge to depreciation reserve is $100,000 a year, or $16,666 for each $1,000,000 of bonds. It should not be assumed, however, that because the financial policy of the two companies is alike and the controlling interests are held by the same men there is any connection further than a working arrangement. The Chicago Edison company as a corporation is in no way identified with the Commonwealth Electric company.

MISCELLANEOUS.

A company has been formed in Berlin with a capital of $1,250,000, to be known as Die Brazilianische Electricitats Gesellschaft, to establish an electric railway and a telephone exchange in Rio Janeiro.

At the Detroit meeting of the American Society of Civil Engineers the subject of one of the papers presented was "Experiments on the Flow of Water in the Six-foot Steel and Wood Pipe Line of the Pioneer Electric Power Company at Ogden, Utah," by Charles D. Marx, Charles B. Wing and Leander M. Hopkins.

In the Canadian government commissioner's report on trade possibilities in Japan, special stress is laid upon the fact that American firms are keeping a close watch upon the electrical industries of Japan, for which there are undoubtedly immense possibilities in the near future. At the present time there is only one electric line in the country, at Kioto; but new electric roads are being projected to extend to the leading trade centers, and there is little doubt that there will soon be a rapidly increasing demand for dynamos, motors and other electrical machinery.

TRADE NEWS.

The Central Electric company of Chicago is issuing a very attractive circular on electrically heated cooking utensils and appliances, and will be pleased to send a copy to anyone on application.

The Fall River Bleachery, at Fall River, Mass., has placed the contract for a new mill with the Berlin Iron Bridge company of East Berlin, Conn. The building is 65 feet wide and 200 feet long, with side walls of stone, the supporting framework being made of steel.

The Western Electric company, in placing upon the market its new long-burning arc lamp, used the name "Midget" in describing it owing to its size, the lamp being but 20 inches in length. The name "Midget," however, is no longer used by the company in describing this lamp, but the name W. E. Petité has been adopted.

Comprehensive, complete and thoroughly up-to-date in every respect must be the verdict of every buyer of electrical material and apparatus after examining the Western Electrical Supply company's general catalogue No. 14. The company has aimed to make it include lighting and railway, house goods and telephone supplies of every description. It is a valuable reference book for the central-station manager, the contractor and engineer.

The Fuel Economizer company of Matteawan, N. Y., reports constantly increasing demand for its product. It has prepared a list of recent sales to electric-lighting, street-railway and power companies aggregating 11,150 horse power. Among these sales was an order from a company that had already placed 11 orders for similar equipment with the Fuel Economizer company, which is accepted by the latter corporation as an unqualified testimonial in favor of its product.

The village of Richmond, Mich., is to have a new electric-light plant. The electrical apparatus is to be furnished by the Westinghouse Electric and Manufacturing company, and the steam plant by the Ball Engine company of Erie, Pa. One of the most complete isolated electric plants in

Columbus, Ohio, will be that of the Peruna Drug Manfacturing company, now being installed. Ball engines aggregating 550 horse power direct-connected to Siemens & Halske generators will furnish the power.

The Electric Appliance company recently issued a little folder calling attention to its self-contained automatic telephone hook. This hook was designed by the manager of the telephone department and is manufactured exclusively by the Electric Appliance company. It is claimed that it can be installed in a smaller space than any other hook on the market. Its installation is very easy as the hook is put together complete in one piece of apparatus, and all that is necessary is to screw it in the telephone box.

Electrical people in general will be interested to know that Martin J. Insull has just announced that he has withdrawn from the firm of Sargent & Lundy and has opened an office at 1013 Monadnock building, Chicago, as manufacturers' agent. Mr. Insull will continue to handle dynamos, motors, incandescent lamps, and other appliances. His long experience with a firm of the high reputation of Sargent & Lundy will, of course, prove valuable in his new business. Mr. Insull has for a number of years practically controlled the branch of Sargent & Lundy's business appertaining to manufacturers' agencies, and his energetic and careful work along that line has been the means of greatly increasing Sargent & Lundy's prosperous business. In addition to the several lines he has already listed, Mr. Insull will establish a few new connections among eastern manufacturers, as it is his purpose now to devote himself exclusively to building a more extensive business. He will, without doubt, hear from a number of eastern concerns desirous of obtaining a reliable and experienced western agent.

BUSINESS.

No better tribute could be paid to the eneregtic proclivities of the Electrical Exchange, Chicago, than the fact that this institution has just placed with Armour & Co., Chicago, one 200 horse power and one 100 horse power Westinghouse generators and also a 500-kilowatt General Electric dynamo. This is only one of a number of large orders recently received by this concern.

The Fort Wayne Electric corporation has secured the services of A. J. Churchward, so long connected with the Excelsior company as electrical engineer. Mr. Churchward is known throughout the country through his successful work in single-phase motors and rotary transformers. His latest patented device is a unique brush-holder, which the government has adopted as standard. As soon as the new factory of the company is completed it will enter extensively into the transmission work.

The Walker company of Cleveland last week received an order for 500 street-railway equipments for European cities. The order came from the Paris agency of the Walker company, and comprised 1,000 25 horse power motors, 1,000 controllers and 500 trolleys. The apparatus will be of the standard make of the Walker company, and will be distributed through cities in Italy, France and Germany. The order is to be filled in 15 months. Apparatus manufactured by the Walker company is now in use in Alexandria, Egypt, in Paris, and in a number of smaller places in France.

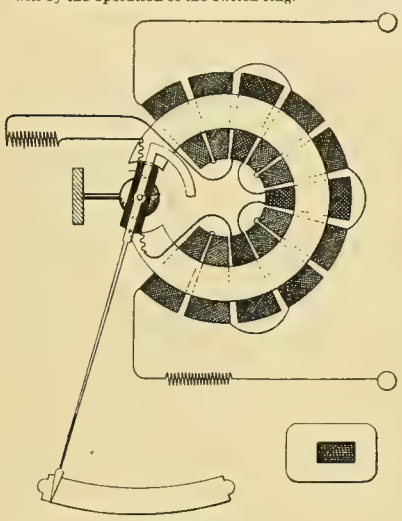
The Buckeye Electric company says regarding efficiency of incandescent lamps, that the initial rating does not always indicate the real value of a lamp, that the poorest grade lamp will, at initial rating, show as good as the best. At periods of four and six hundred hours, however, the loss of candle power shows the inability of the incompetent manufacturer to secure uniformity in all respects. The Buckeye special coiled filament lamp, it is asserted, possesses the combination of sustained candle power, uniform watt consumption, uniform voltage, etc. The western trade is served from the Chicago office, 753 Monadnock building.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued July 26, 1898.

607,830. Device for Operating Electric Switches. James H. Cary, Springfield, Mass. Application filed January 8, 1896.

The combination includes a source of electrical energy, suitable conductors, means for switching in a predetermined amount of electrical energy, one or more rotary electromagnetic motors in the circuit, a switch ring or equivalent device operated by the electromagnetic motor and a supplementary or derived circuit made or broken at will by the operation of the switch ring.



NO. 607,921.

607,918. Crossover for Trolley Systems. Charles E. Davis, Chicago, Ill. Application filed November 21, 1896.

A rigid loop to which the ends of the trolley-wire are adapted to be connected so as to leave a space between them, is provided with engaging pieces adapted to be connected with supporting wires, a bridge piece pivoted to the loop and provided with an actuating device which normally holds it open, the bridge piece projecting above the trolley wire in the path of the trolley wheel so as to be engaged thereby and moved in the plane of the wire so as to connect the two ends of the trolley wire and form a substantially continuous pathway for the trolley wheel.

607,919. Electric Tramway. Alfredo Diatto, Turin, Italy. Application filed December 1, 1896.

An electromagnet having a yielding or flexible connection with the vehicle, a magnet bar made flexible to adapt it to yield to irregularities in the tracks, and means for adjusting the magnet and bar relatively to the ground.

607,921. Electrical Measuring Instrument. George K. Elphinstone, London, and Arthur C. Heap, Penn, England. Application filed May 13, 1898.

The combination includes the electromagnet core, the primary windings disposed thereon, the secondary winding, a pivoted or swinging coil mounted between the poles of the core, and included in closed circuit with the secondary winding, and an indicating device operated by the swinging coil.

607,989. Interior Conduit. Eric E. Erickson and Frederick W. Erickson, Boston, Mass. Application filed June 3, 1898.

The principal features are an outlet insulator consisting of an internally threaded metal member composed of two rings united by a flange or web, and an insulating member fitting over the ends of the rings and into the channel between them, and extending inwardly from the end of the inner ring.

607,992. Igniter for Gas Engines. Ralph B. Hain, Grand Rapids, Mich. Application filed April 8, 1896.

One electrode is fixed and the other movable longitudinally toward and from the first. A spring forms part of the electric circuit and bears at one end upon the outer end of the movable electrode, the spring being secured to a fixed part of the engine and operating to press the movable electrode yieldingly toward the fixed electrode and sliding thereupon. An arm is pivoted at one extremity to a fixed part of the engine and has its other end secured to the movable electrode, and a longitudinally movable rod engages the arm between the pivot thereof and the movable electrode and operates the same to break the circuit.

607,994. Microphone. Thomas J. Howell, London, England. Application filed January 3, 1898.

The invention comprises a honeycomb disk having a series of cells, the front diaphragm, a screw-down cover to hold the diaphragm in place in front of the honeycomb disk, a rear plate extending across the series of cells in the disk and a conducting spring for forcing the rear plate with the honeycomb disk forward as a whole, the cells being filled with carbon granules.

607,997. Electrically Self-propelling Vehicle. Louis Krieger, Paris, France. Application filed March 11, 1897. Patented in France January 22, 1895; in Germany February 6, 1895.

One claim is for the combination with the steering wheels, of an independent armature connected to each wheel, a fixed magnet in conjunction with each armature, a rheostat having independent electrical connections to each armature, and a source of electrical energy, the field-magnet windings and the rheostat being connected in series with the source of electrical energy.

608,013. Reversing Rheostat. Imle E. Storey, Philadelphia, Pa. Application filed January 29, 1898.

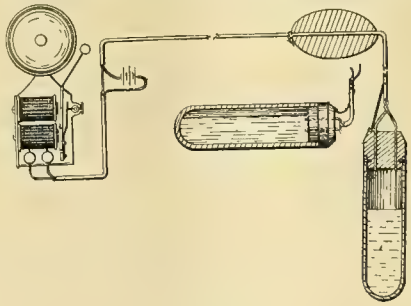
In a motor controller there is the combination of a rotary shaft carrying a crank disk, an abutment on the disk, a toggle lever bearing at one extremity against the abutment and pivoted at a fixed point at the other and a spring connected to the toggle joint.

608,015. Secondary Battery. Georg Walter, Strasburg, Germany. Application filed August 19, 1897.

An instrument for removing detached material from storage batteries, consists of a box-shaped spatula with a handle, and with ridges extending crosswise of the box, the rear side of the box being closed and the lower end thereof being in the form of a thin flat wall.

608,076. Electric Telephone System for Houses. Louis Plaut, New York, N. Y. Application filed September 9, 1897.

A call box is provided with contact plates for the call-bell system, and a cover for the call box is provided with contact plates for the telephone system, a spring-actuated push spindle is guided in the cover of the box and is provided with two contact arms adapted respectively to form contact with the contact plates of the call-bell system in the box and with the plates of the telephone system on the cover.



NO. 608,104.

608,088. Insulated Rail Joint. George A. Weber, New York, N. Y. Application filed November 5, 1897.

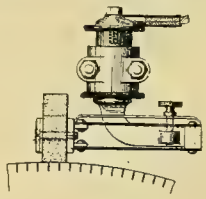
An insulated rail joint, comprising a rail chair for supporting the contiguous ends of rail sections, having a bolt-supporting plate at one edge thereof, insulating material between the ends and the plate, the insulation extending to or near the top of the bolt-supporting plate and conforming to the angle of the rail chair, insulated blocks on each side of the rail sections, a bolt or bolts extending through the insulating blocks, rail, insulation and bolt-supporting plate, and an insulation for the end of the bolt passing through the bolt-supporting plate consisting of a metal flanged thimble, a bushing or insulation between the thimble and bolt and an insulation washer on the bushing between the nut and flange of the metal thimble.

608,104. Electric Sounding Device for Ships. John P. Buckley, New Orleans, La. Application filed December 11, 1897.

A sounder is projected ahead of the ship and is suspended from a suitable float connected with an alarm device, a shell or casing containing a liquid contact maker, electric wires attached to the float, the casing and the alarm device to suspend the casing without giving an alarm, and to give an alarm when the casing is not suspended or partially so.

608,109. Electric Light for Surgical Purposes. Willard E. Dow, Braintree, Mass. Application filed March 26, 1897.

A reflector is provided with a central hollow shank extending axially at its rear, an electric lamp and carrier rod movably arranged within the shank, and means provided to clamp them in adjustment.



NO. 608,135.

608,132. Electrostatic Measuring Instrument. John F. Kelly, Pittsfield, Mass. Application filed April 14, 1898.

A system of magnetic quadrants is so arranged as to have consequent poles, and adapted to be electrically connected with a source of electrical energy and substantially embedded in a dielectric to prevent creeping of the charge, and a relatively movable vane moving within the magnetic field between the consequent poles.

608,133. Means for Preventing Stray Magnetism in Dynamo-electric Machines. John F. Kelly, Pittsfield, Mass. Application filed May 27, 1898.

A dynamo-electric machine having an energizing coil and a magnetic part within the influence of the coil, in which the coil sets up a magneto-motive force in combination with a coil surrounding the part and adapted to produce therein a magneto-motive force which neutralizes and prevents the passage through the part of the magnetic flux produced by the first force.

608,134. Electrical Circuit Controller. Robert Lundell, New York, N. Y. Application filed February 1, 1898.

A normally closed electromagnetic circuit breaker, a current changing device and a translating device such as an electric motor, the circuit breaker being arranged to momentarily interrupt the current supply for the purpose of preventing arcing at the current-changing device.

608,135. Commutator Brush-holder for Dynamo-electric Machines. Robert Lundell, New York, N. Y. Application filed February 4, 1898.

A brush-holder has adjacent brushes rigidly clamped against conducting pieces or blocks which permit them to abut against each other, the conducting blocks in turn being securely fastened to an arm or stud by means of flexible springs.

608,137. Electric Motor for Electrically Propelled Vehicles. Alexander Siemens, London, England. Application filed November 18, 1897. Patented in England January 27, 1892.

The claim is given: In an electromoter for propelling a vehicle, the combination with the axle having an armature secured thereon and rotating therewith, of field magnets located above said armature, pole pieces depending from said field magnets and partly surrounding the armature and extending in a plane at right angles thereto, said pole pieces being formed in two parts having a hinged connection, whereby the lower portions thereof may be swung back to permit the body of the vehicle, with the magnets, to be raised off of the armature, and means for securing the two parts of the pole pieces in fixed relation to each other.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, AUGUST 13, 1898. No. 7

The Telegraph at the Trans-Mississippi and International Exposition.

To those who are familiar with the history of the development of the telegraph in this country the exhibit of the Western Union Telegraph company at the Trans-Mississippi and International Exposition is particularly interesting, as it is largely historical and educational, and is intended to show the successive steps that mark the progress of this important business and to illustrate the present state of perfection attained in the art. Crude apparatus that was used in the early days is shown alongside of that now employed, but the contrast thus presented is no greater than the change in the methods of doing business and the increase in the volume of commercial transactions that are conducted through the agency of the telegraph. An excellent view of the booth of the Western Union Telegraph company in the Electricity building at Omaha is presented on this page. The principal feature of this display is the collection of instruments arranged on tables within the enclosure. Many of these have seen service in the days when telegraph offices were provided with none of the conveniences of the present time, and when very little attention was given to the comfort of the operators. One of these instruments particularly commands the attention of old-timers. It is a Hicks repeater of 1858, and at the time of its introduction was the wonder of the telegraph fraternity. The improved apparatus of the same class is also shown, together with modern instruments for all kinds of work. A special feature is made of the Western Union time, as will be seen by reference to the cut, which shows two of the clocks which have become familiar throughout the country and are relied upon in all large cities for furnishing standard time. The ticker service is also shown in operation.

In the center of the collection of instruments is a bust of Professor Morse, and a portrait of the celebrated American adorns the wall which forms the background for this view. There are likenesses of other celebrities of the telegraph world, including General Eckert and Colonel Clowry. Some historical views, depicting the pioneer work of the company in extending its lines through scantily settled parts of the country, and a number of early messages of great historic value contribute largely to the value of the exhibit for the student. In a conspicuous position is shown a piece of submarine cable which is one of the most highly prized of Western Union relics. It is a piece of the first Atlantic cable which was laid by Cyrus W. Field 40 years ago, and over which the first telegraphic message between the old and new worlds was flashed. At the present time this relic is particularly interesting on account of the attention that has been given the subject of submarine cables since the beginning of the war with Spain. A map of the cable connections of the Western Union company shows the facilities enjoyed by the telegraph companies of the present time and does more to impress the visitor with a sense of the immensity of the business than anything else that is shown. Just now the Western Union Telegraph company operates 190,614 miles of pole and cable lines, including 841,002 miles of wire. It has 21,769 offices in the United States and last year it handled 58,151,684 messages and received in compensation for this service $22,638,859.16. The expenses of maintaining this service amounted to $16,906,656.03, divided as follows: For operating and general expenses, $12,094,161.13; rentals of leased lines, $1,573,497.50; maintenance and reconstruction of lines, $2,345,369.51; taxes, $690,204.98; equipment of offices and wires, $203,422.91.

According to the statistician of the company, the average toll per message was 30.5 cents and the average cost to the company per message was 24.3 cents. As compared with the previous year the business of the company showed a decrease of 608,760 messages, which is explained by the general depression in business throughout the country. During the year, however, the company continued to extend its lines and improve the service in every respect. There were 44 new offices opened, 695 miles of new pole lines built and 14,073 miles of wire added to that already operated by the company. The cost of these improvements was $449,747.07. The rapidity of the growth of the business may be appreciated when it is understood that in 30 years the value of the property, the volume of business and the number of miles of wire operated have increased tenfold, while the average tolls and average expense computed on the number of messages handled have decreased 70 per cent. and 55 per cent. respectively. It may be added the American telegraph service is the most comprehensive in the world and has served as a model for the systems employed in other countries.

It was deemed advisable in connection with the Omaha exposition to illustrate the practical operation of an American telegraph plant, equipped with modern apparatus, and showing the best practice in the art to-day, but it was realized that a working

FIG. 1. THE TELEGRAPH AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—WESTERN UNION TELEGRAPH COMPANY'S EXHIBIT.

exhibit of this character could not be maintained at the exposition and it was determined to have merely the historical section represented at the booth. An excellent idea of the methods employed in the management of an up-to-date telegraph office may be gained by an inspection of the plant at Omaha, which in reality forms a part of the Western Union company's display. Everything about

FIG. 2. THE TELEGRAPH AT THE TRANS MISSISSIPPI AND INTERNATIONAL EXPOSITION.—RECEIVING OFFICE AT THE WESTERN UNION TELEGRAPH COMPANY'S HEADQUARTERS IN OMAHA

the company's headquarters conveys an idea of substantiality. The receiving office, which is shown in Fig. 2, is a commodious apartment having a tile floor, mahogany counter and writing desks, handsome furniture and nicely ornamented walls and ceiling. A return system of pneumatic tubes connects the business office with the operating room on the fifth floor, and everything possible is done to facilitate the rapid handling of business. It is said

FIG. 3 THE TELEGRAPH AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION —MAIN OPERATING ROOM AT THE WESTERN UNION TELEGRAPH COMPANY'S HEADQUARRERS IN OMAHA

of the Omaha office that it was the first to equip its messengers with bicycles, which was done in the summer of 1893, and has since been continued with increasing satisfaction.

The importance of Omaha as a distributing center for telegraph business is constantly increasing, and it is expected that the improvement in the condition of the great Trans-Mississippi section will be marked by a corresponding expansion in the telegraph business. Omaha is the headquarters for the third district of the western division, a territory extending west as far as Ogden and taking in a large number of states and territories. Colonel J. J. Dickey is superintendent of the district and C. B. Horton assistant superintendent. W. W. Umsted is manager for Omaha and South Omaha, and J. P. Barnhart is the chief operator. The Western Union company maintains 16 branch offices in Omaha, eight on the exposition grounds and eight in South Omaha, the great packing-house center. These branches are all under the direction of the Omaha main office, which does not, however, include Council Bluffs. The Omaha office handles about 15,000 messages a day. It is estimated that these messages, counting everything, average 40 words each, making about 600,000 words handled daily. About 100 operators are employed to transact this business, the entire force of the company including over 200 employes of all classes. The operators use typewriters in copying messages. The operating room, which has just been newly fitted up, contains 5,000 square feet—the entire upper floor of the building—and overlooks the city and surrounding country in three directions. The ceiling is high and the room nearly square, making the quarters particularly attractive. A view of this room is presented in Fig. 3. At the end of the room is the switchboard, to which all the wires are brought. There are 160 wires entering the building. The operating room of the main office is equipped with 132 single sets, 17 quadruplex sets, nine duplex sets, one Wheatstone repeater, eight half-sets, three sets of Millikan repeaters, 14 time repeaters and three double-loop repeaters. A first-class ticker service is maintained, and stock quotations are received direct from New York. The time-service department is an important one, over 100 self-winding synchronizing clocks being in service in the business houses of the city of Omaha.

Current for the operation of these lines is furnished from the power equipment illustrated in Fig. 4, which, more than anything else, indicates the great advancement that has been made in modern telegraphy. The most conspicuous feature of the installation is the 15 horse power motor-dynamo set, manufactured by the General Electric company for this class of service. Alternating current is supplied to this equipment from the service mains of the Thomson-Houston Electric Light company of Omaha and is transformed into direct current and delivered to the small motor-dynamo sets, which were furnished by the Crocker-Wheeler Electric company of New York. This outfit comprises two seven-volt 53-ampere machines, two 24-volt 33-ampere machines, three 85-volt 4.4-ampere machines, three 170-volt 4.7-ampere machines, three 255-volt 1.5-ampere machines and three 340-volt 2.4-ampere machines, all compound-wound and admitting of many combinations. This plant was installed at a cost of $12,000, which includes construction, material and apparatus, as well as the labor and expense attending the transformation. It supplanted 11,000 cells of Callaud battery, and it is estimated that a considerable saving was effected by the change, as the yearly expense of maintenance and replacement is about 80 cents to $1 per cell. The cost of maintenance and operation of the present dynamo plant will not be half the cost of maintenance of the battery. Of course the material used in making up the old battery, including glass jars, was shipped to other points where it could be used to advantage. As already mentioned, the company gets current for the operation of the dynamo plant from the central station of the Thomson-Houston Electric Light company, and it has a reserve source of supply from the Millard Hotel and the Omaha Bee plants. Direct 112-volt current can be procured from both of these points, and this can be used in case of emergency or when, for any purpose the company wishes to stop the large transformer. A cons ant supply of current is thus guaranteed under all conditions.

This plant has been greatly admired by visitors to the Omaha exposition, and it may be taken as fairly representative of the highest type of equipment developed by the Western Union company. During the recent general meeting of the American Institute of Electrical Engineers at Omaha the members inspected the equipment critically and complimented Superintendent Dickey and Manager Umsted upon their success in the equipment and management of the office.

COMMUNICATION.

Calculation of the Joint Resistance of Conductors.

To the Editor of the Western Electrician:

I recently saw in an old copy of the American Electrician a rule for the calculation of the joint resistance of line conductors which is correct, but longer and more cumbersome than a method which I wish to suggest to your readers. The rule given is as follows: Multiply all the resistances together; divide this product by each resistance in turn; add the quotients thus obtained, and divide the product of all the resistances by the sum of the quotients; the result will be the joint resistance of the lines.

Suppose that of three lines connected in parallel the resistances are: C = 5 ohms, D = 10 ohms, E = 15 ohms. The example would work out thus:

$5 \times 10 \times 15 = 750$ ohms (product of all resistances).

$750 \div 5 = 150$
$750 \div 10 = 75$
$750 \div 15 = 50$

275 (the sum of the quotients).

$750 \div 275 = 2.8$ ohms (nearly), the joint resistance.

My rule is simpler, I think, and will apply to any number of lines with entire accuracy. Taking the reciprocals of the given resistances I add them together. The reciprocal of the fraction thus obtained, reduced to the proper terms, is the joint resistance sought. Thus, taking C = 5 ohms, D = 10 ohms and E = 15 ohms, as before, we have:

$$\frac{1}{5} + \frac{1}{10} + \frac{1}{15} = \frac{11}{30}.$$

The reciprocal of $\frac{11}{30} = \frac{30}{11} = 2.8$ ohms (nearly) as the joint resistance.

I have found this to be the best and quickest way to work out joint resistances.

HARRY S. ROSS.

Chicago, August 7, 1898.

In Wilbur, Wash., an ordinance has been passed by the council granting to the Inland Telephone and Telegraph company the right to erect and maintain poles, wires, etc., and to lay underground wires for transmission of electricity for telephone and telegraph purposes along the streets in Wilbur.

General Distribution from Central Stations by Direct Currents.[1]

By Louis A. Ferguson.

The subject of central-station distribution by direct currents is one which is so familiar to many of you that I hesitated when asked to write this paper, feeling that it would be difficult to present to you any new thoughts or experiences, so I trust you will pardon me if in the attempt to precipitate discussion and bring to the attention of the meeting the ideas and experiences of others, which is after all the object of my paper, I may go over ground previously explored.

Nor do I wish to be construed as advocating blindly the general use of direct currents under all conditions, for both transmission and distribution of electricity for lighting and power purposes in cities and towns. The records will clearly show, I think, that the writer was the first of the so-called Edison central-station men, who have represented the direct-current idea in central-station lighting, to advocate the introduction of the alternating current as a means of effecting important economies in operating direct-current distribution systems, and also vastly extending the field of operation, which, despite distinct advantages, without this combination might have remained limited to a comparatively small and closely populated area.

The general design of the modern direct-current central station and its equipment has been fairly well established within the last five years, and while it was originally the custom to erect the generating stations as nearly as possible in the electrical center of the city or town, it is now generally conceded that direct current may be more economically distributed from a condensing station situated even a mile distant from the electrical center than from a non-condensing station located at the electrical center of the city. It has been further demonstrated that the former practice of building many central generating stations in various centers of distribution in cities is to be supplanted by the use of one or two large condensing stations generating direct current for distribution throughout the business district, if the station be within one mile of the electrical center of the district, and alternating current for transmission to sub-stations located at the electrical centers of districts more remote from the main generating station. In some cities water for condensing purposes may not be easily obtainable within a distance of one mile, and the location is then merely a question of total cost of land, building and transmission lines to the various distributing stations, proper consideration being given, of course, to the limitations of line voltage and insulation.

In order to show the workings of the first-mentioned type of modern direct-current central-station systems, I will explain in a general way the method of distribution employed in the system of the Chicago Edison company, which I think fairly represents the latest development in direct-current distribution, and leave the explanations of the methods of direct-current distribution in other cities to the representatives of the companies operating them.

The system of distribution is a solid network of underground conductors on the three-wire system, extending from North avenue to Thirty-ninth street, a distance of six miles north and south, and from Lake Michigan to Blue Island avenue, a distance of one and one-half miles east and west. The entire network is continuous from end to end, and is supplied at present from four central stations, all connected in parallel through the network and each feeding into it. The two large stations located at Harrison street and Washington street, on the Chicago River, and known as stations No. 1 and No. 5 respectively, are condensing plants, while the stations on the North and South Sides, located at North Clark and Oak streets and Wabash avenue and Twenty-seventh street, known as stations No. 4 and No. 2 reseptively, are non-condensing. (The districts, with the location of the several plants, are indicated in Fig. 1.)

The total current furnished to the network at the time of maximum load of the system in the winter of 1897 was 50,730 amperes, and is divided as follows:

	Amperes.	Per cent. of total.
Station No. 1	35,600	70.2
Station No. 5	7,600	15.0
Station No. 2	3,400	6.7
Station No. 4	4,130	8.1
	50,730	100.00

The total low-tension direct-current kilowatt-hours output for the stations for the fiscal year of 1897 was 15,255,400, divided as follows:

	Low-tension kilowatt hours	Per cent. of total.	Maximum station voltage	Yearly average station voltage
Station No. 1	[illegible]	[illegible]	[illegible]	[illegible]
Station No. 5	[illegible]	[illegible]	[illegible]	[illegible]
Station No. 2	[illegible]	[illegible]	[illegible]	[illegible]
Station No. 4	[illegible]	[illegible]	[illegible]	[illegible]
	15,255,400	100		

The pressure at the feeder ends throughout the system is maintained at 115 volts on each side of the three-wire system. Although the maximum station pressure is 149 volts, the average pressure of all stations for the year is 126.2 volts, giving an average loss of pressure of 11.2 volts, or 8.8 per cent., which means an average yearly efficiency of distribution of 91.2 per cent. from the station switchboards to the customer's meter.

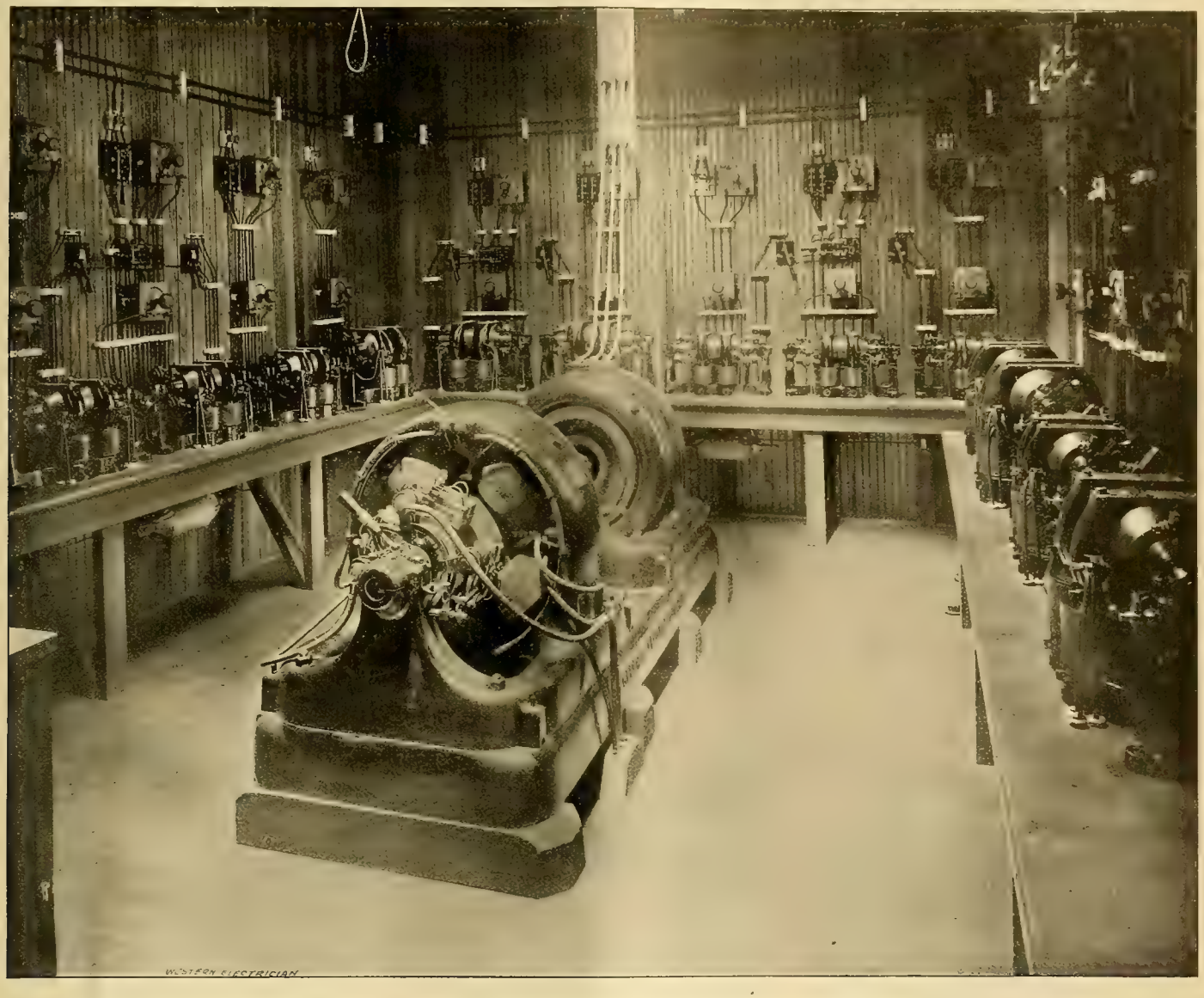


FIG 4. THE TELEGRAPH AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—POWER PLANT AT THE WESTERN UNION TELEGRAPH COMPANY'S HEADQUARTERS IN OMAHA.

The center of distribution in the business district of the city is at Adams street, between Clark and La Salle streets. Station No. 1, which, as has been shown, furnishes 74.3 per cent. of the total low-tension output, is located on the Chicago River, at Harrison street, 3,340 feet distant from the center of distribution at Adams street. Station No. 5, which furnishes 15 per cent. of the total low-tension output, is located on the Chicago River at Washington street, and is 4,500 feet from station No. 1, and 3,000 feet from the Adams street sub-station.

These two stations furnish all the low-tension output for the district bounded by the river on the north, Harmon court (approximately) on the south, Lake Michigan on the east and the river on the west. They also furnish all the energy for the entire low-tension system of the city during the hours from midnight until dusk the following afternoon, and a portion of the output of districts No. 2 and No. 4 from dusk until midnight daily, and ultimatly they will furnish all of the output of the territories mentioned and all of the energy required for alternating transmission lines into the outlying districts of the city and its suburbs.

The load curves "A," shown in Fig. 2, indicate the amperes furnished in district No. 1 by stations No. 1 and No. 5, the small lower curve representing

1. Read before the National Electric Light association, at Chicago, June 8, 1898.

that delivered by station No. 5, the lower large curve showing that delivered by station No. 1, and the upper curve representing the total amperes delivered to district No. 1.

The distribution of current from these two stations to the underground network is as follows:

From station No. 1 to the Adams street sub-station is laid an immense trunk line, known as the Adams street trunk line, having a total cross-sectional area of 66,000,000 circular mils, 28,500,000 circular mils being ordinarily connected on the positive and negative sides and 9,000,000 circular mils in the neutral. The length of this trunk line is 3,340 feet, and is made up of 15 special Edison tubes, each 3,000,000 circular mils area, laid directly in the ground, and 14 1,500,000 circular mils stranded rubber-insulated, lead-covered and juted cables drawn into cement-lined iron ducts. The trunk line on leaving station No. 1 goes down a shaft 60 feet, thence through a brick tunnel built especially for it in the river bed to the east side, where it rises again in another shaft 60 feet into the tunnel house, where a small switchboard is located. The portion of the trunk line in the shafts and tunnel, which is 430 feet in length, is made up entirely of cables; of these 45 are 1,000,000 circular mils Siemens jute-insulated, and 14 are 1,500,000 circular mils General Electric rubber-insulated, leaded, asphalted and iron-armored submarine cables, each supported on iron racks. Where the cables hang vertically in the shaft, the cable is supported by the iron-armored sheathing clasped between iron plates on a heavy cast-iron ring. The copper conductors thus hang in a sort of basket, the strain being distributed throughout the length of the cable. At the tunnel house the 45 Siemens 1,000,000 circular mils cables connect with 15 3,000,000 circular mils single-pole Edison feeder tubes, and together with the 14 1,500,000 circular mils cables are mounted on racks in a large subway, into which the duct line enters about 200 feet east of the tunnel house. At intervals of about 500 feet manholes are built in the Edison tube portion as well as in the conduit portion of the trunk line, thus affording a quick means of locating low-insulation points as they develop. Each of the tubes and cables is provided with an amperemeter at station No. 1, and with switches at both ends, so that they may be completely disconnected from the system in case of trouble. Two of the 3,000,000 circular mils tubes are provided with throw-over switches and arranged so that they may be quickly connected either to the positive or neutral or negative or neutral at will. All of the cables are provided with throw-over switches on both ends, so that they may be operated either as positive or negative at will, thus providing for any possible contingency that may arise. At the Adams street sub-station the trunk line feeds into the main bus-bar in the distribution room, and from the switchboard 42 feeders radiate to various points in the business district, ranging in size from 250,000 circular mils to 1,000,000 circular mils, and in length from 290 feet to 2,831 feet, the average size being 485,000 circular mils and the average length of feeder 1,373 feet.

The maximum current in amperes carried over the trunk line and distributed from the Adams street sub-station last December was 34,400 amperes, the maximum loss of pressure on the trunk line being 12.4 per cent., and to the customer's meter 22.8 per cent., the distance to farthest feeder end being 6,171 feet. In addition to the current furnished to the trunk line, station No. 1 also delivers from its main bus-bar current to the two 1,000,000 circular mil feeders which feed into two points in the southern portion of the business district. One of these feeders, terminating at Wabash avenue and Harrison street, is 3,800 feet in length and carries with maximum station pressure 780 amperes on each side, the other, terminating at Eldredge court and State street, is 4,830 feet in length and carries with maximum station pressure 620 amperes on each side. The supplying of district No. 1 by station No. 5 is done in much the same manner as that just described by the two feeders from station No. 1 into the southern portion of the district. From station No. 5 eight feeders, varying in size from 400,000 circular mils to 1,000,000 circular mils, and in length from 2,175 feet to 4,445 feet, terminating at different points in the northern section of district No. 1, deliver a total of 7,600 amperes at maximum station pressure of 140 volts, the amount of current furnished during the run being only enough to maintain standard system pressure at the feeder ends, the curve of station voltage following very closely that of station No. 1.

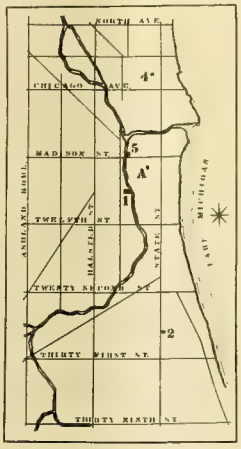


FIG. 1. GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY DIRECT CURRENTS.

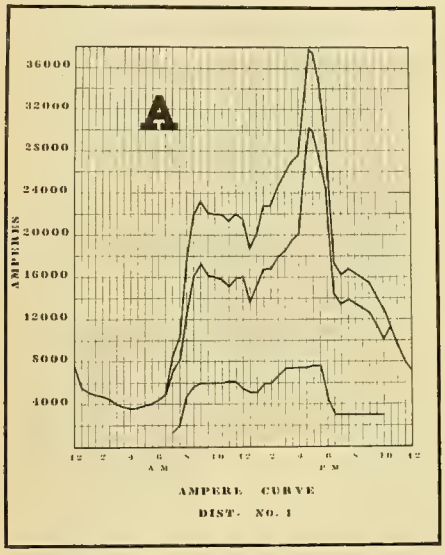


Fig. 2.

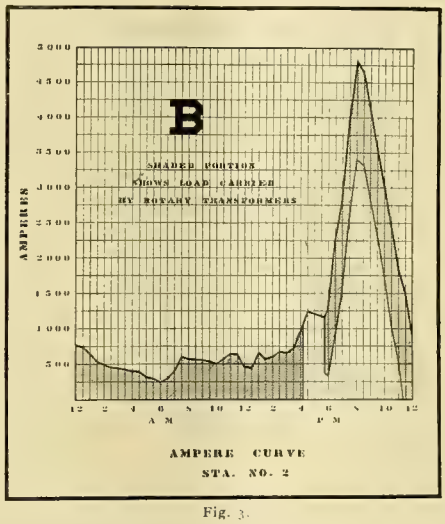


Fig. 3.

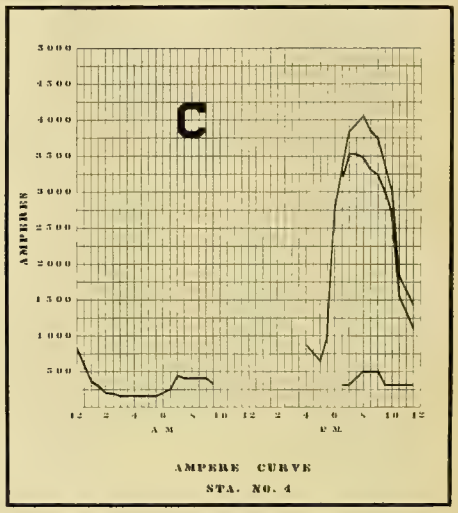


Fig. 4.

GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY DIRECT CURRENTS.

Station No. 2, which is now really a rotary transformer sub-station, is 17,500 feet from station No. 1, and 14,300 from Adams street sub-station. The load diagram "B" (Fig. 3) shows the amperes delivered to district No. 2, the cross-hatched portion representing the current furnished through the rotary transformers and the unshaded portion representing the current furnished by the dynamos in station No. 2, the dynamos and rotary transformers operating in parallel on the three-wire system. The upper curve shows the total amperes delivered to district No. 2.

Station No. 4, which now operates only from dusk till midnight, and will later become a sub-station, is 11,500 feet from station No. 1, 9,000 feet from station No. 5, and 8,000 feet from Adams street sub-station. The load diagram "C" (Fig. 4) shows the amperes delivered to district No. 4. The portion of the curve from midnight until 3:30 p. m. on the winter day and until 6:30 p. m. on the summer day is furnished from district No. 1 through the interconnected underground network, the district No. 4 being, during these hours, merely an extension of district No. 1, and having no distinct supply delivered through its own switchboard. From dusk till midnight the generating plant in station No. 4 is operated, and the current is delivered as shown by the next to the highest curve on the diagram, the low curve marked No. 5 representing the amperes furnished by station No. 5 to district No. 4 over a direct-current tie line between the switchboards of the two stations. The tie line is made up from one feeder running out of station No. 5, originally feeding into district No. 1 and now connecting by means of river cables with a feeder out of station No. 4, which formerly fed into the district at a southern point. This tie line is also used on dark days to keep up the pressure in district No. 4 by connecting onto the main bus in station No. 5 and allowing it to take a small current and deliver it to station No. 4 switchboard, thus relieving the network between districts No. 1 and No. 4 of some of the work. Between the hours of midnight and eight o'clock in the morning there is only one low-tension direct-current generating station operating (station No. 1), supplying direct current to district No. 1, and through the network to district No. 4.

District No. 2 is supplied from station No. 1 by means of a converse rotary transformer, connected to the 250-volt direct-current bus-bars, converting to three-phase alternating current at about 160 volts. By means of step-up transformers this is raised to 4,500 volts, and at this pressure the energy is transmitted by three-phase underground transmission line to station No. 2, where it is reduced by step-down transformers to about 80 volts and converted by means of rotary-current transformers to direct current at about 115 volts.

For the permanent conversion of station No. 2 into a sub-station a pair of special 200-kilowatt generators are being installed, directly coupled to the existing 600 horse power triple-expansion engines in station No. 1. Each generator is provided with a commutator and a set of three collector rings and is designed to deliver from the same armature direct currents and three-phase alternating currents, the direct-current sides of each pair of machines being connected in series to form a three-wire unit, and the alternating-current sides, after passing through transformers stepping up to 4,500 volts, being connected in multiple. The alternating current from these machines will be taken to supply the transmission line to station No. 2, and the balance of the capacity of the machines will be delivered directly into the main direct-current bus-bar of station No. 1, thus keeping the unit operating at full load and maximum efficiency during its run. The peak of the load in district No. 2 arrives later than the peak of district No. 1, so that the same investment in steam and electrical machinery may be employed to take care of a portion of the peak in both districts, these special generators constituting a reserve or surplus for the direct-current equipment of station No. 1.

Lest I might wander from the subject of the paper, I shall not now dwell further upon the question of transmission of energy by alternating currents, although it plays an exceedingly important part in the distribution of electricity by the Chicago Edison company.

Uniformity of pressure throughout an incandescent electric-lighting system is absolutely essential to commercial success. To accomplish this different methods have been proposed at different times. It often happens that the original plan of distribution, laid out by the constructing engineer, does not meet the requirements, after several years' growth of the business, for in all cities lighting business may localize at certain special points, and so demand a remodeling of the existing system of conductors, or require some means of correcting for the inequalities of pressure that are due to the unevenly distributed load.

In the Edison systems built prior to 1890, it was customary to introduce in series with each feeder a resistance box with capacity to carry the entire current of the feeder and of resistance much greater than that of the feeder itself. The resistance box is commonly known as a feeder equalizer. From the end of each feeder where it connected with the mains, a set of pressure wires was run back to the station and there connected to pressure indicators. The method of regulating was to designate the feeder supplying the most important district in the system the standard feeder, and to keep its pressure constant, say, 110 volts. Each pressure indicator of the other feeders was differentially wound, so as to receive the pressure of the standard feeder as well as the pressure of its own feeder. When there was any difference of pressure between the standard feeder and a given feeder, the latter's indicator needle

would deflect to one side or the other, according as the pressure on that feeder was higher or lower than the standard, and if the equal of the standard, the indicating needle would stand in the center. If, then, any indicator showed that its feeder was low in pressure, some resistance would be cut out of its feeder equalizer, and, the resistance diminishing, the volts loss on the feeder would then become less, and thus the feeder could be brought to the same pressure as the standard. If the pressure of the feeder were high, the operation would be the reverse.

With this method of regulation, the entire output of the station must be at such pressure at the station switchboard as will permit the delivery of the correct pressure at the end of that feeder, the product of whose load and resistance is greatest in the system. There are some large stations in America operating to-day on this plan of regulation, notwithstanding that it is an expensive and troublesome one. Another method of regulating, which may be employed where the load is fairly well distributed, is by cutting out the feeders which are high and forcing the current to travel through the remaining feeders and the mains, thus increasing the fall of pressure to the end of the feeders which were formerly high.

The only economical and safe way to regulate in a city where the distances are not abnormally great, and where the load is fairly well distributed, is to so design the conducting system that it will be self-regulating, that is, so that it will require no change of the resistance of feeders or anything of the kind.

A good conducting system should have an ample number of feeders reasonably close together, and the connecting mains should be of generous cross-sectional area.

A valuable adjunct to a station, where there are one or two straggling feeders of great length so located that they cannot be interconnected with the general system so that they may be benefited by such connection, is what is known among the Edison companies as the "booster." The "booster" is a direct-current dynamo wound for a large current and low voltage, and is used for raising the pressure of the station and of the feeders which are ordinarily low. The "booster" dynamo should be series wound and so designed that its voltage will be proportional to the current passing through it, the speed remaining constant. It is connected in series with the feeder whose pressure is to be raised, and is belted to or directly connected with a motor which drives it at the speed for which it is designed. Its action is as follows: The current passing out on the feeder also passes through the field and armature of the "booster" dynamo, and an electromotive force is thus added to that already existing on the feeder, due to the dynamos of the general system. As the load on the feeder increases, the electromotive force of the "booster" dynamo increases proportionately, and adds to that of the feeder, thus overcoming the loss of pressure due to the increased current in the feeder, which enables the feeder to deliver the proper pressure at its mains. The "booster" may also be employed to raise the pressure of a number of feeders which are connected to an auxiliary bus-bar. In this case the "booster" would be connected between the main bus and the auxiliary bus, and would carry all the current of the auxiliary bus, raising the pressure of it as its load increases, and decreasing as the load decreases, as described in the case of the single feeder.

In some central stations two or more potentials or pressures are used, certain dynamos working on a bus-bar at one pressure and the other dynamos working on another bus-bar at different pressures.

This method is only economical when the dynamos can be worked very near the maximum load, which is not often the case. In some cities the dynamos in central stations or machinery or storage batteries in sub-stations feed into one general system at different points, each station or sub-station operating at such pressure as will deliver the same voltage at the feeder end of the mains. This is, without doubt, the method to be recommended as giving the best efficiency and assuring reliability of service throughout the system.

With the method proposed, in case of accident to any one station, either by fire or lack of water supply, the whole system will not be shut down, but each station will take its share of load which comes from the shutting down of the disabled station.

Municipal legislation in all large cities requires, and very justly so, that the wires for the distribution of electricity for lighting and power purposes should be laid underground. The Edison companies throughout the country use a standard system of underground, the mains and feeders consisting of japanned iron pipe, in which are three solid copper wires or rods insulated from each other and from the iron pipe by an asphaltum compound. These pipes or "tubes," as they are commonly called, are 20 feet in length, the copper conductors projecting three inches on each end, making the total length of each pipe 20 feet six inches.

The copper conductors are connected together by means of a flexible coupling, composed of a stranded copper cable about eight inches in length, and having copper terminals on either end, and which are provided with a circular opening of such diameter as will permit the reception of the copper conductor of the tube. The copper terminal is heated by the flame from a blow lamp, and the copper conductor is soldered into the terminal.

After the three couplings are connected an iron ball clamp is bolted onto the tube near the end, and a cast-iron oval-shaped coupling box is laid over the copper joint and fastened together by bolts and nuts. The coupling box is then filled with hot insulating compound, and after this has settled by cooling, the box is again filled and the opening covered by plugs.

At each street intersection these tubes enter a junction box. The junction box is a cylindrical cast-iron box in the center of which is a cast-iron upright standard carrying three rings of flat copper bar. To one of these rings all of the positive conductors are connected, to another ring all the negative conductors, and to the remaining ring all of the neutral conductors are connected in a similar manner.

Many of the junction boxes are fed by a feeder direct from the central station, the feeder, when Edison tubes are used, being laid in the same manner as the mains before described. The feeders in a three-wire system consist of three conductors, as in the case of mains, with the exception that one conductor which is used as a neutral has usually one-third the area in cross-section of either of the two other conductors. Feeder tubes are made in various sizes, from 250,000 circular mils up to 3,000,000 circular mils. Each feeder tube also contains three small insulated copper wires, which are connected in each coupling box to the corresponding wires in the next tube, thus making a continuous circuit from the feeder end in the junction box at street intersection back to the station. At the generating station these wires connect with a pair of voltmeters, and at the end of the feeder they are connected through fusible strips to the copper rings in the junction box, thus giving in the station the pressure or difference of potential at the feeder end. By means of the junction boxes the system becomes one grand network of conductors connected in multiple and fed at many points by feeders from the central station, similar to that of a well-designed gas or water system in a large city. By means of this network of mains the electrical pressure is equalized thoughout the system, and the current is distributed properly among the feeders. Every mechanical and electrical detail of the system is very carefully worked out and absolutely interchangeable, and it is without question, when cables are used for the feeders, the most complete, most easily operated and most permanent underground system yet devised for the distribution of electricity for large cities using a direct-current system of 500 volts and under. With this system the customers are almost absolutely certain to have continuous service, as they are fed from two points under ordinary conditions, and should the main on their block burn out, it is nearly always possible for the company to feed the customer from one or another junction box. The method of coupling affords a perfect house to house system of distribution, and renders the placing of services a very easy and simple matter. The system is very easily laid down, and its maintenance compares favorably with other methods of distribution.

The maintenance of good pressure regulation at the customer's meter is very much more easily effected with an interconnected direct-current distribution, such as been described, than with the ordinary alternating-current central-station system, such as has been exploited in this country.

Owing to the parallel operating of direct-current dynamos and distribution systems, the fluctuations in the pressure, due to change over from one machine to another, so prevalent in the ordinary American alternating-current central station, and so annoying to customers, are eliminated, and a carefully operated direct-current central station should show a pressure chart with an average deviation from the mean of less than one volt.

It is possible, of course, and often the careless practice in direct-current stations to have bad fluctuations of pressure at the times of change over, and also irregularities at other periods, but there is absolutely no excuse for their existence in a well operated and well planned direct-current system.

The parallel operating of the generators greatly simplifies the maintaining of uniform pressure regulation at the lamps, since when several units are connected to the common bus-bar the regulation for the entire system may be effected by careful attention to one unit, whereas in alternating-current stations where the generators do not operate in parallel it is necessary, in order to even approach the uniformity of pressure regulation which exists in direct-current systems operating in parallel, to regulate the pressure accurately on each unit, which is seldom done in practice. Besides the better regulation possible with parallel operating of the dynamos, a further distinct advantage is derived from the economy effected by proper division of load among the units in the stations, this being particularly marked when the distribution systems are also interconnected. Each unit, irrespective of size, may be usefully and efficiently employed at the period of maximum load, and the amount of idle or uneconomically employed investment is reduced to a minimum.

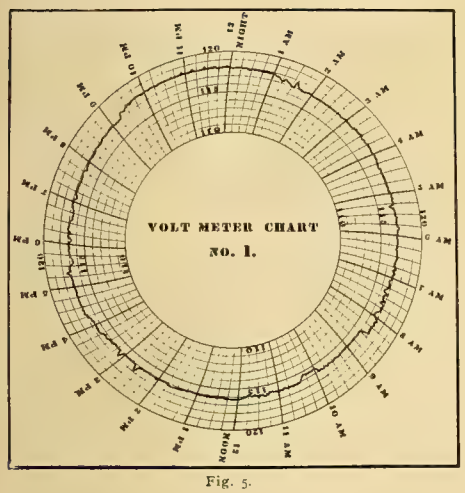


Fig. 5.

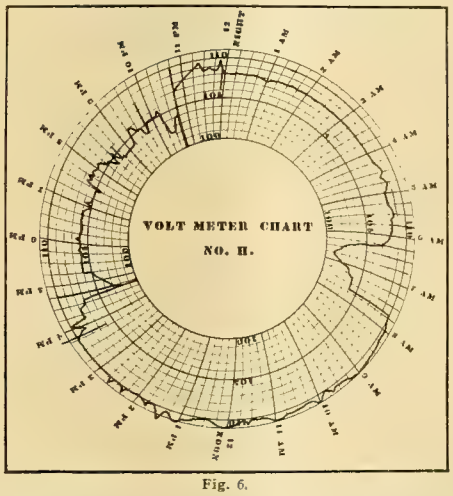


Fig. 6.

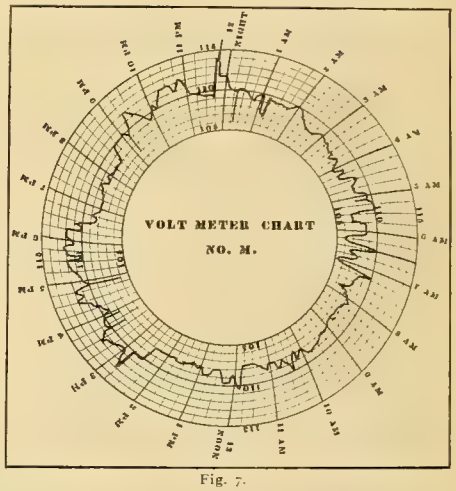


Fig. 7.

GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY DIRECT CURRENTS.

To illustrate the comparative accuracy of regulation obtainable in an interconnected direct-current system, and in the ordinary type of independent-circuit alternating-current system, let us refer to the pressure charts shown in Figs. 5, 6 and 7.

Fig. 5 represents the pressure for 24 hours on the direct-current distribution system in the business district of Chicago. The average deviation from the mean pressure is less than one volt. Fig. 6 represents the pressure on one of the circuits of a single-phase, house-to-house transformer, alternating system in Chicago. Fig. 7 represents the pressure regulation of an alternating-current system on a long avenue, where are used primary feeders with four 15-kilowatt transformers, the secondaries in multiple on the three-wire system.

If the engineer designing a system employing alternating current in the distribution, expects to obtain first-class pressure regulation, he must follow those lines laid down by the engineers who have developed the modern direct-current distribution system. The distribution system of mains should be interconected, forming one grand network of conductors with large transformers, located at points where feeders would terminate if it were a low-tension direct-current system, and to these transformers should be brought the primary feeders from the central station, provided with boosting transformers or induction regulators. Pressure wires from the secondaries of the transformers should be brought back to the station, so that the pressure on the ends of the mains may be known

[*Continued on page 94.*]

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A Washington dispatch says that the Bureau of Internal Revenue has decided that "electric belts, not being a medicinal preparation, need not be stamped."

Does this ruling signify that anything which is not what it is represented to be is exempt from taxation?

Spanish newspaper readers are experiencing all the anxiety and annoyance that Americans have been subjected to through conflicting reports concerning the condition of the cable lines between Cuba and the rest of the world. A specimen of the reports published in Madrid is found in the Correspondencia de España, which says in one paragraph: "It is officially announced that the cable to Santiago has been cut. Later information is to the effect that cable communication has been restored." This and similar announcements are reported with slight variations each day.

Stringing wires from pole to pole is deemed within the range of ordinary intelligence by the Supreme Judicial Court of Massachusetts, which has sustained a refusal to admit the opinion of an electrical expert as to whether the method of dealing with a certain wire was a proper one. The court held that the work of stringing wires, even through the branches of an intervening tree, involved only matters of ordinary knowledge and experience, such as men in general understand and comprehend without expert assistance, and that technical experience would not be instructive. That the wire was intended for the transmission of electricity, it says, was immaterial.

The Soo has been selected by the Association of Edison Illuminating companies for its annual meeting this year, and it has been determined to make the trip by steamer. The arrangements have already been published in this journal, and the programme for the convention outlined. The organization will enjoy the advantages of a pleasure trip to and from the place of meeting, amid pleasant surroundings and in congenial company. This year's meeting should certainly be successful in point of attendance, as well as in the work undertaken, and at the present time it promises to fulfill the most sanguine expectations in both respects.

An interesting experiment in telegraphing across space was conducted by Marconi recently for the benefit of the Dublin Daily Express and the Dublin Evening Mail, which desired to make a practical test of the possibilities of wireless telegraphy applied to modern journalism. Signor Marconi went to Dublin to conduct the trial, which consisted in the transmission of descriptions of the yacht races sailed under the rules of the Royal Alfred Yacht Club. The messages were sent from distances varying from five to 10 miles, and were published in successive editions of the Evening Mail. Not a hitch occurred, the instruments working splendidly, and not a single message had to be repeated. Signor Marconi was the operator in the cabin of the Daily Express steam-tug The Flying Huntress, and the messages were received by his chief assistant, Mr. Kemp, at the land station in Kingstown, from which point they were telephoned to the offices of the Express and Evening Mail on a wire especially erected by the telephone company, which, with representatives of telegraph and cable companies, is closely following the experiments. It can readily be understood that for work of this kind wireless telegraphy should prove of great value. With suitable equipment in the press boats following the yachts and provision for receiving the messages on shore, details could be telegraphed as the race progressed and the result communicated immediately on the conclusion of the contest. A considerable saving of time could be effected in this manner.

As a result of the experience gained in caring for the wounded in the Spanish-American war the X-ray has come to be regarded as an important factor in military surgery. Dr. William M. Gray, the microscopist at the Army Medical Museum in Washington, who has just returned from Siboney, says that the only important advancement in medical science that was brought prominently into practice in the Cuban expedition was in the utilization of X-rays for the first time in this country's military operations. There had been some experience in the last Greek war, and incomplete reports had been received by the medical fraternity of the use of apparatus of this nature during the outbreaks in English possessions, but the experience in this country had been confined to laboratory experiments and hospital practice. Excellent results were obtained, however, and Dr. Gray is authority for the statement that many of the poor fellows who were wounded in Cuba might have lost limbs on the operating table had not the X-ray disclosed the fact that it was unnecessary to use the knife.

Another important acknowledgment of the value of this discovery is found in a contribution to the Medical Review under the title, "Recent Experiences in Military Surgery After the Battle of Santiago." Lieut.-Col. N. Senn, M. D., U. S. V., who is chief of the operating staff with the army in the field, writes of the value of the X-ray as an instrument of diagnosis as follows:

The value of the probe as a diagnostic instrument in locating bullets has in modern military service been almost entirely superseded by dissection and the employment of the X-ray. If from the nature of the injury and the symptoms presented the bullet is located in a part of the body readily and safely accessible to the knife, and it is deemed advisable and expedient to remove it, this can often be done more expeditiously, and with a greater degree of certainty, by enlarging the track made by the bullet than by relying on the probe in finding and on the forceps in extracting the bullet. If, as is often the case, the whereabouts of the bullet is not known, its presence and exact location can, by the use of the X-ray, be determined without any pain or any additional risks to the patient. All of the bullets removed on board the hospital ship Relief were located in this manner. Dr. Gray, an expert in sciagraphy, who has charge of the scientific work of the floating hospital, has been of the greatest service to the surgeons in enabling them to locate bullets and in guiding them as to the advisability of undertaking an operation for their removal.

Mention has already been made in the Western Electrician of the application of the X-ray to the surgical work in the Marine Hospital at Stapleton, and the valuable assistance rendered the surgeons through the examination of complicated injuries by means of the sciagraph. The experience of Dr. Senn and Dr. Gray confirms these good reports. Moreover, it amply repays those enthusiasts who devoted so much time and expended so much money in the study of this wonderful scientific discovery and in acquiring information upon this subject that has proved so valuable to the medical men attending the American army and navy in the West Indies.

It is a matter of national pride, too, that Americans should have attained such skill and that their efforts should have been attended with such marked success in this new field, where so many European scientists seem to have made such little progress. Professor Küttner of Tübingen, who followed the last Greek war in connection with the German Red Cross society, says the London Lancet, has made some interesting experiments with the Röntgen rays at the Constantinople Hospital. In his report he says that while the apparatus proved of service when applied with the screen, it was rarely possible to take a satisfactory sciagraph on account of the difficulty of bringing the patients into the proper position. The former method proved often the only way to ascertain the site of a projectile which had entered the body and had remained there. This was applicable to all parts of the body except the stomach and head. A bullet in the brain, for instance, showed very indistinctly.

A London contemporary calls attention to the fact that last spring an arrangement of mirrors was exhibited at the Royal Institution, where a sciagraph of the brain showed in relief, thus enabling the operator not only to see the foreign body, but also to measure correctly its distance from the outer wall of the cranium.

American experts have made successful examinations of the brain and stomach by means of the sciagraph, and pictures of this kind have been published in the Western Electrician.

Professor Küttner says it is noteworthy that splinters of bullets and of bone which had penetrated into the soft parts of the body could not be distinguished from each other. Moreover, he says, it was proved that the opinion that deep-lying masses of pus could be located was erroneous. Injuries to the central nervous system, the spinal cord, and the peripheral nerves were solely ascertainable by the aid of the Röntgen rays. It was impossible to do this before. Furthermore, it could be seen whether a bone was totally or only partially severed—a matter of great importance in therapeutics. For shot wounds in the extremities he recommends that a sciagraph be taken. His conclusion is that the Röntgen rays are of great importance for medical aid in war, but only for fixed hospitals, such as reserve hospitals and those installed in fortresses, while for moving field hospitals their application is very limited.

WAR NEWS.

The Auxiliary Cruiser St. Paul.—The four great ships chartered from the International Navigation company for the use of the government during the war with Spain are about to be disarmed, and unless some unforeseen contingency should arise to make their service necessary in a prolonged war they will very soon be returned to their owner and resume their accustomed employment as trans-Atlantic liners. These ships were of great service to the government, and it is a matter of gratification to every true American that at least one of the lines crossing the Atlantic is made up of vessels flying the flag of the United States and available for the service of this country in time of war. It would be well if there were more like them.

These four liners, ordinarily in the New York-Southampton service, were the largest ships of the large number of vessels temporarily added to the navy of the United States. They were the St. Louis of 11,269 tons; St. Paul, 11,600 tons; New York (Harvard), 10,803 tons, and Paris (Yale), 10,795 tons. The ships are all slightly in excess of 550 feet in length and have an average speed of about 20 or 21 knots an hour. The St. Paul is the fastest, with a record of an average speed of 21.08 knots an hour on a passage from Southampton made two years ago. The St. Paul and the St. Louis are American-built.

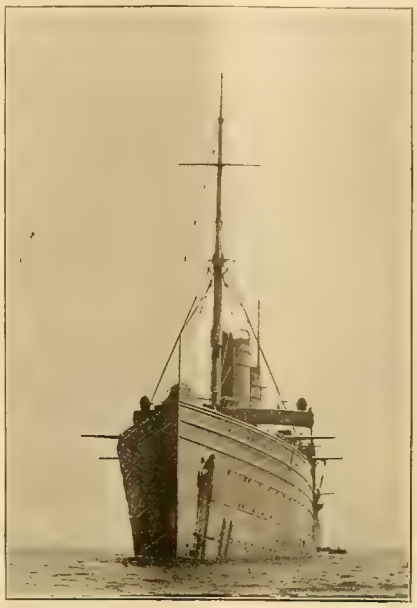
All of the ships were armed as auxiliary cruisers. They were used in the blockading service, in engagement with torpedo boats, as dispatch boats, in cable-cutting expeditions, as transports or supply ships and for hospital and relief service. Their size and speed made them very valuable. Each ship was in charge of naval officers, who directed the movements and fighting operations of the vessel, although the regular complement of officers and men worked the ship.

Captain Sigsbee, now detailed to the Texas, was in command of the St. Paul, the newest and fastest of the four. This ship, which is herewith illustrated, was supplied with an armament consisting of six five-inch rapid-firing rifles, six six-pounders and six three-pounders. Some of the guns are shown in the bow view. The larger picture is a reproduction of a photograph of the after-deck, showing a searchlight and two rapid-fire guns mounted on top of the second-cabin smoking room. In the original photograph the lens of the projector shows faintly, upside down, a reflection of the photographer and his camera as they appeared while the picture was being taken. This searchlight was supplied with current from the electric-lighting plant of the ship, which supplies current to about 1,200 incandescent lamps. Twelve engines are used for the dynamos and fans that light and ventilate the ship. The two main driving engines are quadruple-expansion and have a combined capacity of about 20,000 horse power. The boiler pressure is 200 pounds to the square inch, and 10 boilers of the Scotch type, with 72 furnaces, raise the steam. In addition to the engines mentioned there are 49 others, used in the various mechanical operations on the ship.

Cable Operators at Manila.—The London Times publishes an interesting letter from an English cable operator in Manila, who, on behalf of himself and fellows, resents the statement that during the bombardment the operators fled to save their lives. This gentleman's account is as follows:

On the morning of May 1st Cavite was bombarded by the American squadron, and the Spanish fleet was destroyed. During the whole of the action the staff of the cable company, from the superintendent downwards, were at their posts, although their office is situated only 200 yards from a Spanish battery, which several times opened fire on the American ships, which fortunately did not reply. Having completed the destruction of the Spanish fleet and Cavite arsenal, the American commodore lined his ships up in front of Manila, with their guns trained on every shore battery, with the evident intention of commencing a bombardment should a single shot be fired on his squadron from any one of the latter. The servants of the cable company were, all this time, in their office, transmitting the telegrams which were handed to them, as if nothing unusual had happened. On the evening of May 2d the Hongkong cable became interrupted while one of the operators was in the act of receiving a telegram from Hongkong. Two of the servants of the company immediately proceeded to the cable-house on the beach, which is within a stone's throw of the battery, which was still threatened by the American guns, and having set up the testing apparatus, proved to their satisfaction that the cable was broken about ten miles from the shore. After the interruption of the Hongkong cable the occupation of the cable company's staff was nearly gone, but they still maintained the telegraphic service to Panay and the neighboring islands until May 23d, when the Panay cable was also severed about five miles from Manila, and cable communication thereby entirely cut off. Since that date the Englishmen who have been represented as having fled for their lives on May 1st have been standing by their office day and night, although the building has since the 5th inst. been repeatedly struck and even pierced by bullets from the insurgent forces, who have since that date been maintaining a determined attack on the Spanish entrenchments in the neighborhood. I do not make these representations in any boastful spirit. The cable staff, of which I am a member, are merely trying to serve their employers' interests to the best of their abilities, and, although they have been given by the directors of the company *carte blanche* to retire to a place of safety, the European members of the staff are still standing to their posts, in the hope of being able to restore cable communication should they be allowed to make the attempt.

Submarine Mines.—The removal or explosion of the harbor mines furnish many an interesting item for the Atlantic-coast newspapers. The New York Sun relates that a number of the submarine mines recently taken up in New York harbor were found to have rusted around the caps. These mines were put aside until some means of unscrewing the caps, so as to get out the gun-cotton, could be devised. The danger of doing this work lay in the possibility of sparks flying when the rusty caps were turned. One of the mines was placed in a sort of cradle that had been built on a raft and lashed down tight. Then the cap was connected with a fly wheel so that when the wheel went around it would unscrew it. An electric motor attached to the wheel was connected by wires with a source of electricity on shore and the raft was then sent out into the Narrows about 150 feet. A couple of seconds after the wheel has started there was a terrific explosion. The mine disappeared in fragments, the wheel with it, and the raft was sent flying. Just what caused the explosion will never



AUXILIARY CRUISER ST. PAUL.

be known, but there is little doubt that the friction when the rusty cap was turned caused a spark. The force of the explosion broke the windows in several houses at Fort Wadsworth, but nobody was hurt.

A Baltimore account states that three large ground mines, each containing 250 pounds of dynamite, were purposely exploded off Hawkins Point simultaneously by the touch of an electric button on shore, and the effect was terrible. The mines were about 100 feet apart, and an immense triangle of solid water was thrown to a height of 110 feet in the air. The instantaneous pressure on the side or bottom of a ship would have been at least 12,000 pounds to the square inch, and this is said by the authorities to be a "disabling blow" to modern ironclads.

In relation to the reported explosion of three mines under water in the Potomac River by lightning, the Washington correspondent of the Baltimore Sun has this to say: "Each mine seems to have been exploded separately, although all were struck within a few seconds of one another, and the fact that none of their neighbors was disturbed by the concussion is regarded as remarkable by the experts who have examined the remaining mines. General Wilson says it is not known whether one flash fired all three, or that one mine was hit and the other two were set off by the concussion caused by the explosion of 200 pounds of gun-cotton. He knows that the mines were about three feet under water at low tide and probably [illegible] neither the battery ashore in the casemate was injured nor the cables connecting the mines with it. The mines, he believes, were probably struck by lightning, and the fact that they were [illegible] seems to have afforded no protection, although General Wilson says he is unable to say how the lightning entered the water and hit them."

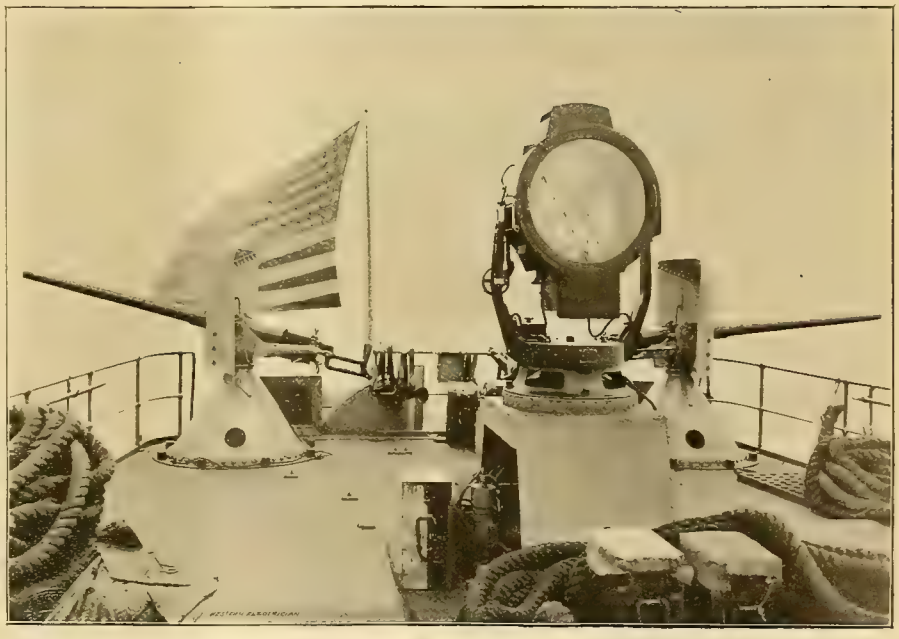
War Taxes.—The Georgia state railroad commission has delivered a unanimous ruling on cases against the telegraph and express companies doing business in that state which were argued before the commission. These cases were brought by business organizations and individuals to compel the telegraph and express companies to pay for internal revenue stamps on messages and receipts. The commission decides that the sender of a telegraph message must pay for the stamp, but expresses the opinion that the law intends that the telegraph company should place a stamp on each message it delivers. As to stamps on express receipts, the commission takes the ground that the act intended that this tax should be paid by the company, and issues a peremptory order requiring express companies in the state to supply stamps for receipts without charge to shippers, or without increase of present charges. The telegraph and express companies, being non-resident corporations, will appeal at once to the federal courts.

The Santa Fe Railway company has begun suit at Topeka to compel the Western Union Telegraph company to accept and transmit railroad messages to which no revenue stamps have been affixed, under the railroad's contract.

Mr. Maxim on American Gunners.—Hiram S. Maxim, the American engineer living in England, whose work is familiar to all engaged in electrical or mechanical pursuits, publishes a letter in the St. James Gazette which answers in admirable spirit the absurd charge that British gunners should have the credit for the shooting on American warships. Mr. Maxim's letter is worth quoting:

"During the last few days I have noticed a number of letters and paragraphs relating to the alleged abduction and employment of British gunners on the American ships. It appears to the writers of some of these that the wonderfully accurate shooting which proved so disastrous to the Spanish fleet, both at Manila and Santiago, can only be accounted for on the hypothesis that English gunners were employed. It is very curious how we Americans look upon the same subject from a diametrically opposite standpoint. The wonderful accuracy of our fire seems to us to point to the fact that our naval authorities had taken great care in selecting their gunners, and that every man behind a big gun must have been a genuine American. The very fact that our losses were so small as compared with those of the enemy would seem to point in the same direction. I have nothing but admiration for the skill of English gunners, and there is no question that, with the single exception of the Americans, they are the best in the world; but it must be remembered that Americans have given much greater attention to the question of accuracy of fire than any other nation, and that they have various improvements in the mountings of their guns which enable them to be fired with greater accuracy than is possible in other countries. When I was in Washington, several years ago, the naval authorities told me that in case of war the superior accuracy of our

[*Continued on page 95.*]



AUXILIARY CRUISER ST. PAUL—AFTER DECK, SHOWING SEARCHLIGHT.

DEVELOPMENT OF THE TELEPHONE FIELD.

Evolution of the Line Signal.[1]

By Arthur Vaughn Abbott.

Part I.

A careful observer at the first great American exposition, the Philadelphia Centennial, might have noticed a fine wire running along a gallery in Machinery Hall, terminating at either end of the building in a small closet. Continued investigation would have disclosed a curious trumpet-shaped apparatus into which the wire extended, whereby an attentive listener could, with the aid of a vivid imagination, distinguish articulated sentences delivered at the other extremity of the wire. Such was the first public exhibition of the telephone, whereby the transmission of speech by electricity became a fact, and in the quarter of a century which has since elapsed electrical arachnids have been so industriously spinning a copper web that upwards of 600,000 miles of telephone wire now cover this continent, placing some 400,000 persons in talking relations with each other, and annually transmitting about 900,000,000 messages. But the invention of the telephone was only half the solution of the transmission problem, for the instrument itself was useless without the necessary connecting circuit

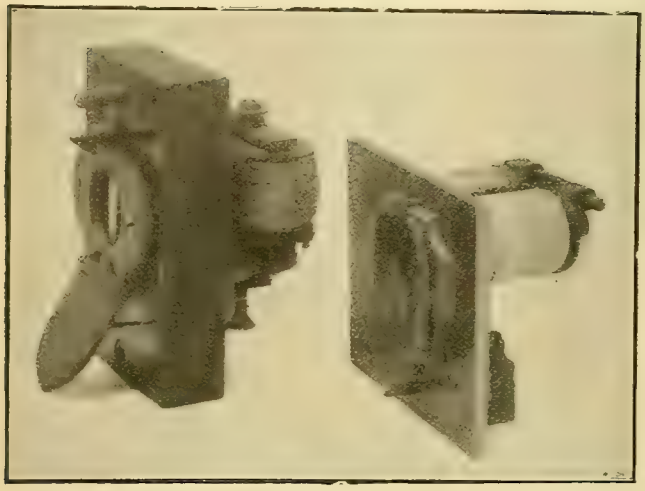


Fig. 1.

Fig. 2.

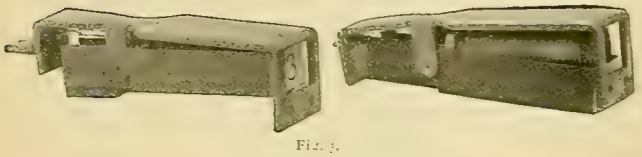


Fig. 3.

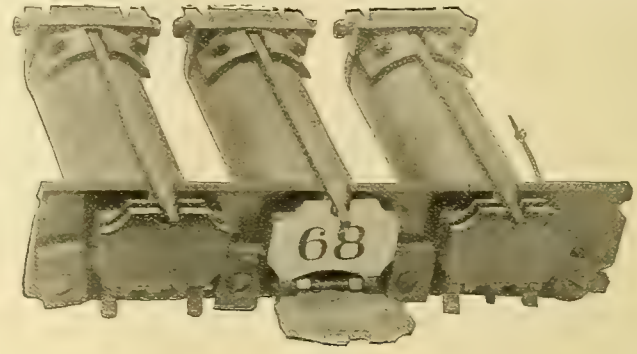


Fig. 2

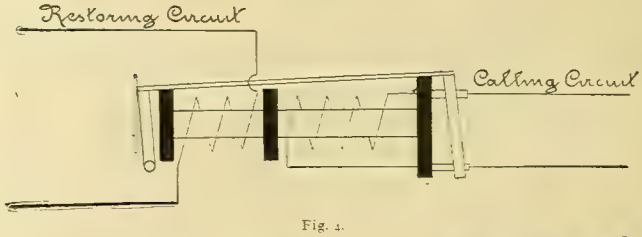


Fig. 4.

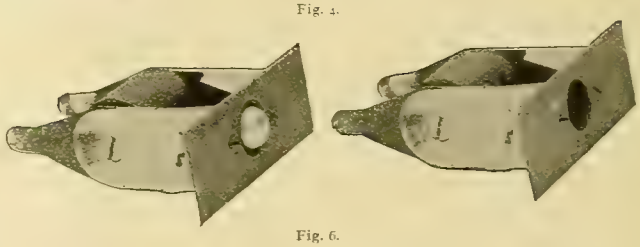


Fig. 6.

EVOLUTION OF THE LINE SIGNAL.

mally retained in a vertical position a door or shutter. Electrical excitement of the spools released the catch and allowed the shutter to fall forward, disclosing a name or number painted upon its inner surface. From the falling shutter, this piece of apparatus obtained the euphonious name of "drop," and as originally designed it was exceedingly clumsy, occupying a space of two inches by 3¼ inches. A very slight exhibition of mechanical skill sufficed to refine and compact it to a notable degree, developing the form shown upon the right-hand of Fig. 1. When it was attempted, however, to set annunciators of this description in sufficient proximity to each other to place before a single operator such a number of lines as it was possible for one person to serve adequately, much difficulty was experienced, due to the cross-talk developed by magnetic leakage between the spools of adjacent signals.

Increased mechanical skill and electrical knowledge obviated the cross-talk difficulty by ironcladding, as shown in Fig. 2, and in this form, known as the "tubular drop," the line signal remained in statu quo for a number of years, and is still very widely employed. But in spite of improved mechanical and electrical details the tubular drop proved itself to be anything but an efficient signal. The falling shutter frequently did not attract the notice of the operator, even though the latter were careful and attentive. Accumulation of dust, either around the trunnions supporting the armature, or under the shutter hook, prevented the shutter from falling, and if adjusted for maximum sensitiveness, the slightest earth current, or the discharge from a summer thunder-shower was often sufficient to display the signals of an entire switchboard. It is necessary to restore manually the shutter every time it falls, thus necessitating a considerable expenditure of time and energy for this purpose, and so the next step was the so-called self-restoring drop shown in Fig. 3.

Here great skill has been displayed in mechanically designing and constructing the signal. The head of the drop is provided with a double shutter, one being of thick and heavy iron and retained in its place by a lever catch connected to the rear armature; the other, a thin outer flap of aluminum that normally conceals the number painted upon the iron disk. Electrically, as shown in Fig. 4, there are two spools. The right-hand winding is designed for the calling circuit, and when excited attracts the rear armature of the drop, lifting the catch and allowing the heavy iron shutter to fall forward, thus raising the aluminum flap and disclosing the number. The other winding comprises the restoring circuit, consisting of a smaller spool, which may be excited by a battery controlled by the operator in front of whom the drop is placed, the magnetism thus developed being sufficient to pull the heavy iron shutter back into its place, allowing the aluminum flap and catch to return, thus restoring the drop to its calling position.

Line signals should possess five characteristics, namely: Certainty in operation, ability to immediately attract attention, positiveness in the information conveyed, compactness, automatic operation.

The attempt to attain all of these features simultaneously has given rise to hosts of devices which, for purposes of classification, may be roughly divided into three groups: Electric signals, electromechanical signals and luminous signals.

The self-restoring drop is the best illustration of a signal of the first class. The excitation of the tripping coil by the subscriber's ringing current exhibits the signal, while with the second circuit the operator electrically restores the signal to its normal position. The second division is exemplified by the devices shown in Figs. 5 and 6. The contrivance illustrated in Fig. 5 is a particularly successful one, as it is reliable, compact and automatic. It consists of a spool surrounded by a pivoted sheet-iron armature. Normally, the armature occupies the position shown at the right-hand of the illustration and is out of sight, but on exciting the spool the magnetization induced causes the armature to rise into the position shown at the left of the illustration, displaying the number painted upon the face of the armature. From the method of operation, this signal has received the suggestive cognomen of "tip-up." Unfortunately, this signal is only well adapted for use where battery currents are employed, as it is not so effective with alternating currents, and in order for the signal to remain visible the magnet must be continuously excited. The arrangement shown in Fig. 6 is ingenious and seems to possess much merit, but has never received a wide application. The usual exciting spool is supplied with a pair of projecting pole-pieces which surround a slightly inclined tube. In this tube a silvered steel ball is placed and the tube so inclined that normally the ball rolls out of view. When the spool is excited the magnetization developed causes the ball to roll forward and to project through a plate covering the orifice of the tube, which also prevents it from being expelled and lost.

Receivers and transmitters are now much the same as they were twenty years ago, but a vast amount of skill and ingenuity has been expended upon apparatus for rapidly, effectually and economically placing subscribers in talking relations with each other, and the telephonist of to-day is essentially a "transmission engineer."

When telephonic communication is limited to two persons, it is simplicity itself to connect them by the requisite circuit, and provide proper signals to attract attention to the reception of messages, but when the number of correspondents in a single locality is to be numbered by thousands and tens of thousands, it is physically and financially impossible to erect a line from each station to all of the others, so early telephone undertakings developed the idea of the "central office," to which lines from all subscribers in the immediate vicinity converge, equipped with the necessary paraphernalia for interconnecting at pleasure any pair of circuits. To carry out the exchange system, the first requisite is to provide each circuit with some form of apparatus whereby the person desiring to send a message may gain the attention of the central office attendant. As the early telephonists comprised many recruits from the "locksmith and bell-hanger school," to which the degree of "electrician" had recently been added on account of a supposed familiarity with the installation of electric bells, it is not surprising that the earliest line signal was the then crude form of hotel annunciator. It consisted, as is shown on the left of Fig. 1, of a pair of bulky spools wound with cotton-covered wire, over which an armature was pivoted, carrying a catch that nor-

[1] Read at the fifteenth general meeting of the American Institute of Electrical Engineers, Omaha, June 21, 1898.

Damages for Telephone Line.

Rochester, N. Y., has decided that there shall be no compromise with the farmers who claim damages because of the city's telephone line along their property to Hemlock Lake, and Commissioners Thomas J. Neville, Irving Paine and Joseph H. Sherman will go ahead and condemn the property. The attorney for many of the farmers is Mr. Clark of Batavia, and he recently made an offer to the law committee of the council to settle the matter. His terms were $4 for each telephone pole, damages to be paid in each case for trees injured, $2 for guy poles, and $25 to be paid the attorney for each of the 57 clients he represented. This involved a payment of about $4,500 for the poles and $1,325 for attorney fees, besides several thousand dollars for damages to trees, the aggregate amount being practically in the neighborhood of $8,000. The offer was rejected, and condemnation proceedings will follow.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

New Richmond, Wis., is to have a local telephone system at once, A. J. Presson having completed arrangements for its establishment.

Little Falls, Minn., expects to receive much benefit from the recent increase of the capital stock of the Northwestern Telephone company. An exchange will be built at that point.

The council has refused to renew the Des Moines charter of the Iowa Telephone company and litigation is expected. The claim is made that the company's right is perpetual, subject to the city regulation of rates.

Maple Lake, Minn., expects to have telephone communication with Minneapolis at an early date.

It is reported from Des Moines that the Boone County Telephone company and the Marshall Telephone company are effecting the consolidation of the independent lines into one company.

By making a reduction from $36 to $24 to business houses at Madison the Iowa Telephone company has found it necessary to add quite an extension to its switchboard.

The Jefferson County Telephone company has begun work west of Fairfield, Ia., to extend the toll lines to Batavia.

A. M. Childs, formerly of Sioux City, has taken the management of the Fort Dodge exchange of the Iowa Telephone company.

The Northwestern Telephone company has gained permission from the city authorities of St. Paul to remove its Marshall avenue line to another street instead of putting the wires underground.

Red Wing, Minn., is impatiently waiting for the establishment of the telephone system, for which preparations are being made.

Word comes from Wheaton, Minn., that the poles for the new local system have arrived. It will include Graceville, Clinton, Ortonville and Wheaton, with an exchange in each place.

The lines of the Central Minnesota Telephone company are extended to Delano, Minn., and an exchange in both Minneapolis and St. Paul is promised by January.

The Wisconsin Telephone company is changing its system at Washburn from the automatic to the grounded circuit. An exchange will be added.

Owners of shade trees are having trouble with the Western Electric company in the neighborhood of Mankato, but it is expected that the Mankato-St. Peter line will soon be completed.

Langford, S. D., now has telephone communication with the rest of the world and Britton, S. D., in particular.

The Western Electric Light and Telephone company of Britt, Ia., has put 1,000 miles of wire in use this year. T. A. May is manager of the company.

Merchants of Muskegon, Mich., have a bone to pick with the express companies for throwing out the Citizens' company telephone and forcing the people to use Bell instruments.

The Fort Dodge Telephone company had little trouble getting a franchise at the polls.

Ex-Mayor J. A. Manley of Grand Forks, B. C., had the privilege of sending the first message over the new telephone line between that place and Marcus, Wash.

The people of Ira and Baxter, Ia., who have been talking about a telephone service, will soon be able to fulfill their promises, as the line is approaching.

George Nevitt of Clinton, Ia., was badly burned by a live wire. He is employed by the Marshall Telephone company.

Nearly 500 telephones are listed in the directory of the old telephone company in Burlington, Ia.

Every town in Wayne County, Ia., is now supplied with telephone exchange. There are 30 telephones at Humeston.

Waukesha is attempting to compel the telephone, electric-light and telegraph companies to put the wires underground. The companies object.

The first office of the new Bell telephone line through southern Minnesota was opened at Hokah recently. The line will run to Austin from La Crosse.

The Bell company has its line ready for business at Brighton, Ia.

The Home company of Cedar Rapids, Ia., has engaged the services of C. W. Barrett of Des Moines to build the new exchange. Work has been begun.

At Woodbine, Ia., a sort of sample telephone election took place. There were 75 votes for and five against the granting of a franchise to the Iowa company. Smithland, Ia., voted 55 to one to grant a telephone franchise.

A line is being built from Truro, Ia., to St. Charles.

B. W. Huntley of Spring Valley, Minn., and George R. Thompson of Chatfield are leading an enterprise to provide Spring Valley with an exchange. There is talk of completing the system in six weeks.

Many citizens of Alexandria, Minn., are in the Alexandria Telephone company. First-class service is promised. The lines will probably include clubs at Lake Miltona and Parkers Prairie.

The Iowa State Board of Review has levied a tax of 3⅓ per cent. on the assessed valuation of telephone lines. The assessment of the Iowa company is increased from $174,000 to $221,000. The Mutual Telephone company of Des Moines was assessed at $10,000 upon a valuation of $40,000. The American Telegraph and Telephone company [illegible] sessed at $50.

English Telephone News.

In England the construction companies hail with delight the prospect of competition in some form or other. At the meeting of the Consolidated Telephone Construction and Manufacturing company the directors referred to this subject in their annual report, saying: "The shareh[illegible] no doubt aware of the desire of many important cities, such as Glasgow, Manchester, etc., to have their own telephone exchanges, and your directors are hopeful that licenses will eventually be granted by the postmaster-general, whereby a large demand for telephones and all materials connected therewith may reasonably be expected by this company, as being the largest and oldest manufacturing company in the United Kingdom for such specialties. As a case in point, a license for an exchange has recently been granted by the postmaster-general to the states of Guernsey, and the telephones required have been supplied by this company. Friendly relations continue with the various government departments, both at home and in the colonies, and it is also satisfactory that nearly all the railway companies of the United Kingdom place their orders with us for telephones and accessories connected therewith. Contracts for 12 months' supply have in some cases been entered into."

The parliamentary telephone inquiry is proceeding slowly. Mr. Gaine, the general manager and solicitor of the National Telephone company, said that the early policy of the company had been to open call offices to subscribers free, but as the business increased this policy had to be abandoned. He was not afraid of competition with equal powers. There was no doubt, Mr. Gaine continued, that not only in England, but in nearly all other countries the telephone system was started on the wrong lines. It ought to have been based upon the plan of payment by messages. They had tried the system in Sheffield, giving 1,000 calls for £7, and charging 1d. a call afterwards. There was a meeting of protest in Sheffield, and the company had to drop the scheme. One gentleman told him that he would have to pay £95 a year on the suggested scale. The telephone ought to have been started on that principle, but it was too late to do it now, certainly by the National company.

When Mr. Preece was questioned he said, comparing the telephone service in Germany with that in England, and taking the countries as a whole, England was in advance of Germany. He admitted that in certain towns in Germany—Berlin, Hamburg and Cologne—the telephone had been developed to a phenomenal extent, and that in those particular instances they are far in advance. Continuing, Mr. Preece said that the rates were lower. This was explained by the fact that the telephones in Germany were in the hands of the Postoffice, which was unhampered by any restrictions. In Germany, however, no night service was given. In Mr. Preece's opinion there should be a very much greater development of the telephone system in England, and especially in the direction of allowing payment by message to be made. That system had been a great success in American cities, and the number of subscribers continued to increase enormously. The Postoffice was only too anxious to have an opportunity of extending the telephone service, but it required a free hand. He was strongly opposed to licenses being given to municipalities, believing that such a step would further complicate a very complicated question. Mr. Preece stated that the desire to hand over the telephone service to the municipalities was based on three assumptions. First, that the Postoffice could not do the work properly and cheaply; secondly, that the telephone company did not do the work properly, and thirdly, that the municipalities could do the work better and cheaper. All these three assumptions were wrong. The telephone company was doing the work most perfectly; and it could only compete with the Postoffice in Leicester, Newcastle and Hull by making its system equally efficient. In those towns it had adopted the metallic circuit. Wherever the company was allowed to lay its wires underground it did the work as well as it was done anywhere abroad, and certainly better than in Germany. Again, whatever were the difficulties and anomalies of the present arrangements, where there were two parties concerned, they would be greatly intensified by the introduction of a third party. Ultimately the Postoffice would have to buy two systems instead of one. He thought that one reason why the telephone system had not spread much in London was that the local telegraph system was so magnificently organized.

Telephone trunk-line extension is progressing in England. Dunston and Cowbridge have been connected with the trunk-line telephonic communication of the country.

The postmaster-general has announced that this year the Treasury has sanctioned the erection of a large number of additional circuits between important centers, and that a bill for raising a further sum of £1,000,000 as telephone capital is now under the consideration of Parliament. Regarding a suggestion that "with a view to relieving the wires during business hours, a lower rate should be charged for [illegible] Mr. Dyke [illegible] he could [illegible] to the [illegible] telegraph [illegible]

The report of the directors of the National Telephone company for the [illegible] was presented at the general [illegible] London on July 27. [illegible] of £36,855. After deducting the Postoffice royalties, amounting to £49,665, there remained a profit balance of £190,550, as compared with £171,978, for the corresponding period of 1897, being an increase of £18,572. The rentals carried forward for unexpired terms of running contracts amounted to £565,620, as compared with £499,963 at corresponding period of 1897, or an increase of £65,657. Out of the available balance of £167,854 the directors recommended dividends on the first and second preference shares at the rate of six per cent. per annum, less income tax; the third preference at the rate of five per cent. per annum, less income tax; ordinary shares at the rate of six per cent. per annum, free of income tax; carrying £50,000 to reserve and about £5,000 forward.

Telephones for Fergus Falls, Minn.

The people of Fergus Falls, Minn., have been looking forward for some time to the completion of the new telephone system which has just been constructed by Jones & Winter. The projectors of the enterprise were Robert Hannah and F. G. Barrows, who have associated with them W. H. Davy of Moorhead. They start in with a hundred subscribers, and many others are waiting to have telephones installed. The rate is $2 per month for business houses and $1 for residences. There will be at least 150 telephones in use in the city before the close of the year. The exchange will be located in the Midway building, on Mill street. In addition to the local system a line will be established to Pelican Rapids, so that the people there can talk with the county seat. This service will cost 25 cents, and will be of great assistance in the transaction of business. The local paper calls attention to another advantage: "It is not improbable that it will be used quite a little by farmers along the route, as sometimes it is very profitable to know what the price of wheat is before one starts to town." The company will also build a line to Wadena, New York Mills and Perham, as soon as the poles can be secured, thus bringing all parts of Otter Tail County in speaking distance.

Another Set-back for Bell Interests.

On August 4th Judge Hagner, in the District of Columbia Supreme Court, rendered a decision against the Chesapeake and Potomac Telephone company, and granted an order restraining it from removing instruments from subscribers who refused to pay more than $50 a year rental. Congress enacted a law limiting the charges to $50 a year for each instrument in the District of Columbia. Subscribers in Washington refused to pay more, and the telephone company attempted to remove the instruments. James F. Manning & Co. began legal proceedings to restrain the telephone company from such action. The latter alleged that the act referred only to government service, and that as otherwise applied it was unconstitutional. Judge Hagner overruled all of the company's objections and granted a temporary restraining order.

Routes for Telephone Lines.

The legal duty imposed upon municipal bodies by the New Jersey telegraph companies act of April 27, 1888, to designate streets and highways on which a telegraph or telephone line may be constructed, exists only for the construction of such a line through the municipality, and does not arise with respect to the construction of a local system of telephone lines within the municipality, according to the ruling of the Supreme Court of that state, in the action of the state against the Common Council of the city of New Brunswick, June 13th.

Extensions and Improvements.

The Gila Valley Telephone company, with capital of $9,000, has been incorporated at Solomonville, Ariz.

A new telephone line is to be put up from Fullerton, Cal., to Placentia, and it will probably be extended to the Santa Fe oil wells.

A local tlephone company was organized at Wyneewood, I. T., recently to build telephone lines to Roff, McGee, Center, Brady and Foster, giving telephone connections to all country towns of importance.

The Calhoun County Telephone company, Battle Creek, Mich., reports that it is now installing its instruments and that it expects to open the exchange within two weeks. The company is said to be erecting a model independent exchange, with full copper construction and equipping it with the Stromberg-Carlson central-energy system.

General Distribution From Central Stations by Direct Currents.

[*Continued from page 80.*]

and properly controlled. Such a system will be described to you in detail by Mr. Wagner, and I am sure he will agree with me when I say that the single-phase, house-to-house transformer, separate-circuit alternating-current system, such as has been generally exploited in this country, has nothing to recommend it to the central-station manager, either from a purely engineering or financial standpoint, although it has fulfilled its mission as a pioneer in the introduction of electric lighting in scattered districts.

One of the advantages to be derived from the use of direct-current distribution, as distinct from alternating-current distribution, is the employment of storage batteries. They may be adopted for use in various ways, in sub-stations in outlying districts where the load-factor of the district is very small, in the central stations themselves to deliver the entire output during period of minimum load, at the centers of distribution for discharging during the peak, as auxiliaries in rotary transformer sub-stations for discharge use at the time of the maximum load in the main central station. In addition to any one of the various ways which the battery may be employed, it always acts as a reserve, guaranteeing the consumer good service, in much the same manner as a bank surplus is a guaranty to the depositors in case of financial emergency.

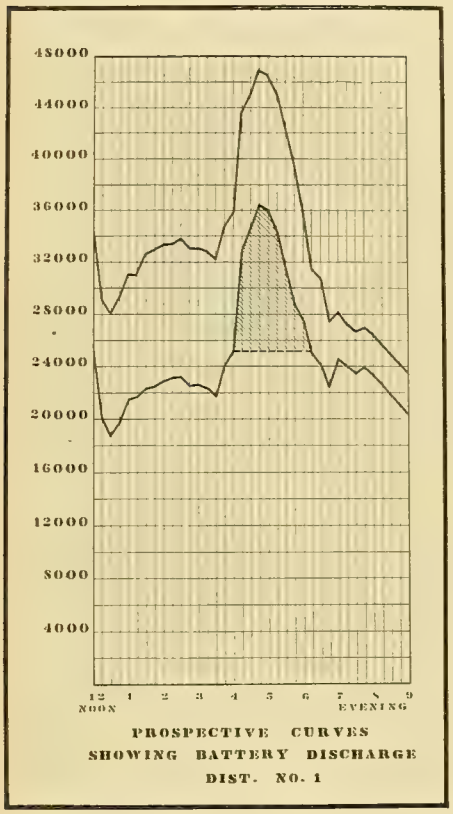


FIG. 8. GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY DIRECT CURRENTS.

Storage batteries, when installed in central stations or centers of distribution, are usually connected to the main bus and allowed to float on the system, taking a charging current from the bus or discharging into the bus, according to the load on the system, the generating units being worked at such load as will insure the best efficiency of the entire system.

Batteries are economically valuable in connection with the distribution of direct current in systems whose load curve has an average peak width of not more than two hours, since the investment required for storage batteries to carry the peak having an average width of less than two hours is less than the investment required in steam and electrical machinery to do the same work. The storage battery also has the same value that exists in the case of moving machinery as a reserve in meeting sudden increases of load, provided such increase of load does not continue for a sufficient period to wholly discharge the battery and insufficient time remain for recharging before the ordinary load peak of the system appears at the regularly appointed time. Such a condition is rarely, and I might say almost never, met with, although in rare instances we may approach this condition. (Fig. 8 represents prospective curves showing battery discharge in district No. 1.)

The steam and electrical machinery is rated by the horse power or kilowatt, and the duration of the load peak does not influence the value of the investment, since the machinery may be operated for the full 24 hours at its maximum capacity. The storage battery, however, is rated by the horse power hour or kilowatt-hour, and the investment is nearly directly proportional to the number of hours during which it discharges the maximum capacity, so that if we required the battery to be prepared to carry the full peak prolonged for seven or eight hours every day the investment in battery would be enormous as compared with steam and electrical machinery to furnish the same kilowatt-hours' output. Illustrative of such contingency, let me refer you to the load diagram marked "D" (Fig. 9), representing the load in the business district of Chicago, December 20, 1897. This is a very extraordinary curve, illustrating the limitation of the storage battery and the possibility of its being rendered ineffective had the early morning peak extended to the arrival of the regular afternoon peak, without affording sufficient time for recharging the battery.

The storage battery has a very distinct value, which is seldom recognized and employed to its full advantage, when located at the central distributing point of a system with feeders radiating to various points in the network. The battery may be provided with two or more end-cell switches, so arranged that they may be connected in multiple and feed into the main distributing feeder bus, or they may connect also to one or more auxiliary bus-bars with a different number of cells in series, feeding into each bus, thus providing two or more potentials at the center of distribution. It will be found that when only one pressure is maintained at the center of distribution during the time of maximum load of a large district that the pressure at the ends of the short feeders will be somewhat higher than the standard and they will be overloaded, and at the end of long feeders the pressure will be lower and the feeders underloaded, although the pressure variation at other times may be negligible. Under such conditions the storage battery becomes exceedingly valuable, for by arranging it to operate at two or more potentials, the long feeders may be connected during the time of maximum load to the auxiliary bus or buses and additional current forced over them, utilizing their full capacity and maintaining a uniform feeder-end pressure by means of an investment in end cells very slight as compared with the investment in additional feeders and mains required to accomplish the same result.

The direct-current distribution system is very much better adapted to electric-elevator work than the alternating-current distribution, and as far as I am able to learn there has not yet been developed a commercially successful direct-coupled electric elevator capable of running at varying speeds and operated by alternating currents.

The direct-connected electric elevator is a piece of apparatus which is of the greatest value to the central-station companies, since it is practically the key to the isolated-plant situation, and with its aid we are enabled in a large percentage of instances to show to the owners of large mercantile establishments and buildings a decided saving in the purchasing from the central-station company of electricity for lighting, elevator and general power service as compared with the cost of operating an isolated plant, using hydraulic elevators. The immense advantage to the central-station companies in being able to supply commercially successful electric-elevator service economically may be realized when we consider that there is connected to the systems of the Edison companies in New York, Boston, Brooklyn and Chicago 15,000 horse power capacity in direct-connected elevators, representing a gross income of approximately $375,000 annually. At the present time alternating-current distributing systems confine us to the use of continuous running motors belted or geared to the elevator pump or winding equipment; but such an arrangement is not fitted for first-class passenger service, and is very uneconomical, and similar equipments using direct-current motors were in use 10 years ago and have long since become obsolete and have been entirely superseded by the direct-coupled electric elevator which operates for approximately one-half the cost.

The use of low-tension constant-potential arc lamps connected in multiple to the distribution system has made rapid strides during the last three years, and in New York, Brooklyn, Boston, Chicago and other cities is fast superseding the use of series arc lamps wherever the low-tension mains operate, and the day is not far distant when series arc lamps will be employed not only in the outlying districts, where there is not sufficient business to warrant the extension of the low-tension distribution system. The competition effected by the Welsbach gas-burner has done much to develop the constant-potential arc lamp, and it is safe to say that with incandescent lighting alone the central-station companies are rendered helpless against the improved gas-burners; but a successful competitor has been found in the use of the three and one-half ampere direct-current enclosed arc lamp, and as proof of this we have only to compare the results of the central-station companies in the large cities where these small arc lamps have been employed with the conditions existing in the small towns where alternating-current systems of distribution furnish incandescent lighting only. In the latter places the Welsbach light is found to be in general use and is affecting very seriously the earnings of these small central stations, owing to the lack of an alternating-current arc lamp which would answer the purpose of the small-ampere arc lamp used in connection with direct-current systems. Although very much has been done within the last year in the development of the large alternating-current arc lamp, it is still far from being in the state of perfection, and cannot be said to compare practically or economically with the constant-potential direct-current enclosed arc lamp.

The use of motorcycles and electric cabs employing storage batteries is becoming more popular every day, and in London and Paris they are used very largely, in Paris an automobile club having been formed by people owning motorcycles. The central-station companies using direct current will undoubtedly find a profitable outlet for their product as the motor cycle becomes more popular, and by locating charging stations for the motorcycles along the central-station mains the use of the motorcycle will become more extended.

When we consider the many practical advantages inherent to the direct-current system of distribution which add so greatly to the commercial success of a central-station company, it would seem that the original investment required to establish the plant and system should not be the only question affecting the selection of the system to be adopted.

It is universally conceded by all competent and unprejudiced engineers that the alternating-current system of distribution in a closely settled district, which shall approach in commercial value the direct-current distribution system, shall be one which has for its basis an interconnected system of secondary mains, with transformers of large capacity, and high-pressure feeders from the central station to these transformers and generators in the station operated in parallel, as previously described. Therefore the cost of the distribution network in the case of the alternating-current system will not be less than that of the direct-current network, and the cost of transformers, high-pressure feeders and al-

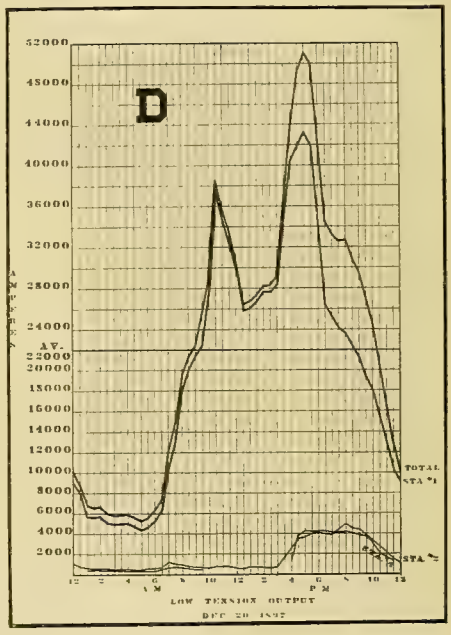


FIG. 9. GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY DIRECT CURRENTS.

ternating-current dynamos should be compared with the cost of low-tension feeders and low-tension dynamos of the same capacity, these forming the only points of comparison. The investment in each case depends merely upon the advantageous location of the central station in each individual city.

I have shown in the early portion of the paper that in a large distribution system, such as exists in Chicago, that 75 per cent. of the total energy supplied to the system is delivered to the business portion of the city covering an area of one square mile, the stations supplying this territory being three-fifths of a mile from its electrical center. It is therefore self-evident that since such a large portion of the energy supplied is so nearly adjacent to the desirable location of the central station that direct-current distribution system should form the basis of the general system of the company.

It seems to the writer that the useful field of operation for alternating-current distribution system is not in large cities, but rather in the scattered suburban residence districts and small towns, where commercial lighting, elevator service and general power distribution forms an insignificant portion of the demand and where the first cost of the direct-current installation would so far exceed that of the alternating-current system of distribution with primary mains and large transformers for blocks of lighting as to make the interest charges so great that the property would be rendered unremunerative.

The successful central-station company of the future will be, as outlined in my paper read before the Association of Edison Illuminating Companies at its last convention, the one combining intelligently the use of alternating and direct currents, employing direct current in the distribution systems in the thickly settled business and residence districts of a city and alternating current for the distribution systems in the scattered residence districts and surrounding suburbs. The energy will be gen-

erated at one or two large condensing stations located where water and fuel may be obtained at the minimum cost and the energy transmitted to the various sub-stations located at the electrical centers of the distribution systems. The choice of low-pressure direct-current or high-pressure alternating current for the transmission to the sub-stations will depend upon their relative distance from the generating stations. rotary transformers or other forms of current rectifiers being employed in the sub-stations which supply the direct-current distribution networks when alternating currents are used for the transmission.

Large American Engine-dynamos for London.

The Westinghouse Machine company and the Westinghouse Electric and Manufacturing company recently invited a number of prominent engineers to their works at East Pittsburg to inspect some remarkable new engines and generators which are about to be shipped to England. The visitors saw three 2,500 horse power electrical generators direct-connected to three 2,500 horse power engines, which were constructed for the Metropolitan Electric Supply company of London.

It is worthy of remark that while it is no new circumstance for England to send to America for electrical apparatus, it is a new circumstance for England to send to America for large steam engines. The generators and the engines which drive them are the largest of their type ever constructed, and they embody many new and interesting features in design and construction.

The Metropolitan Electric Supply company is the greatest electric lighting company in Europe, and its present contract with the Westinghouse interests calls for "three compound two-phase steam alternators," each consisting of an inclosed vertical compound engine with the armature of the generator coupled direct to the engine crank-shaft, the engine and generator being mounted on separate bed plates.

The engines and generators are so designed that the full output can be obtained at any speed from 116 to 145 revolutions per minute, this range of speed being necessary in order to provide a variation in the frequency of the alternations, and thus enabling a supply to be given to existing transformers in London.

The engines are of the inclosed vertical compound marine type, and they are the most powerful engines yet made at East Pittsburg.

The electrical apparatus built by the Westinghouse Electric and Manufacturing company, accompanying these engines, consists of three direct-connected alternating-current generators, delivering two-phase currents at a pressure of 500 volts. The armature or the revolving element of each generator, as before mentioned, is mounted directly on the engine shaft.

There is one direct-current multipolar exciter to each generator, which is arranged for direct connection to the engine shaft.

This plant is to supply primarily arc and incandescent lighting to London, but a portion of the power is to be used for operating rotary transformers, which in turn supply current to direct-current motors and for charging storage batteries by the three-wire direct-current system.

The Metropolitan Electric Supply company of London is planning new central stations and newly equipping old ones, and it is likely that the Westinghouse companies will be called upon to supply many additional engines and generators before the work now begun is completed.

WAR NEWS.

[*Continued from page 91.*]

fire would be so great as to be a most important factor in the struggle. Is not this accuracy due in some measure to the fact that the very large guns in the American navy are trained by electricity, which enables a species of telescopic sight to be employed which is completely impracticable with guns trained by hand?"

Miscellaneous Notes.—The war signal service along the New England coast has been discontinued. The service was under the supervision of Captain Weeks of the naval militia, whose headquarters were on board the old frigate Minnesota. A complete circuit was established along the entire coast, and thus it was made impossible for a foreign warship to approach any place on the coast without detection.

Chief Endicott of the Bureau of Yards and Docks has requested the secretary of the navy to have the force of civil engineers of the naval service increased by four, so that the corps will number 20 officers. The war has greatly added to the duties of the civil engineers, and they have been embarrassed by the curtailment of their force through the suspension of A. G. Menocal and U. S. G. White and the absence of R. E. Peary, the Arctic explorer. The latest appointment to the corps of civil engineers is J. G. W. Walker, a son of Rear Admiral John G. Walker.

It is said that enterprising sailors on the ships engaged in cable cutting during the war have started quite a trade in cable souvenirs. Some of these cable sections are genuine, but it is feared that many of them made a sudden appearance in port in obedience to the law of supply and demand.

Protection for Ocean Travelers.

The sinking of the French liner La Bourgogne and the terrible loss of life attending that disaster have attracted universal attention to the fact that travelers are exposed to great dangers from collisions at sea and from icebergs, especially during fogs. Under the most favorable conditions, it has been pointed out, the means at hand are very imperfect, and much dependence must necessarily be placed in agencies which would not be selected excepting where nothing else was obtainable. Devices which depend upon auricular signals like the eophone and the topophone are only valuable, of course, in the presence of another vessel equipped with a similar system and where the signals are faithfully sounded at regular intervals. Even then it has been observed that under certain atmospheric conditions signals that are sounded by one ship may not be heard by another in the immediate vicinity, although a vessel much farther away may detect them.

Mr. Hermann Herberts of Newark, N. J., discusses this question in a communication to the Western Electrician, in which he suggests the use of the thermopile for detecting the presence of a ship or an iceberg. The subject has interested him deeply, he says, because of an experience in early life.

"Some years ago I myself witnessed a collision about 60 miles off the coast of England," he says. "It occurred about eight o'clock in the evening, with the moon brightly shining. We were towed into an English port, where we remained for three days until the damage was repaired. This was comparatively a trivial affair, as no lives were lost, but the scenes on board gave me an idea of how easily a

HERMANN HERBERTS.

few persons losing their self-control may affect a large crowd. It is hard to describe the strain one undergoes when in such position, with escape from impending danger apparently cut off."

Concerning the precautions now taken and the means employed to detect and interpret signals, Mr. Herberts calls attention particularly to the fact that "under existing conditions it is necessary that both vessels be active, not only in giving signals, but also in 'attempting' to intercept them. The safety of a vessel consequently not only rests with its own crew, but largely depends upon the watchfulness of the other vessels. A good deal of blind confidence is therefore required."

The suggestion that "wireless telegraphy" be employed is disposed of by the same objection, that dependence must be placed on the crew of another vessel, even assuming that every craft afloat would be provided with suitable equipment and that the necessary degree of watchfulness be shown. Then, too, under the most favorable conditions there would still be the danger arising from icebergs and floating wrecks, which frequently prove a source of great danger in navigation.

In presenting his solution of the problem, Mr. Herberts does not pretend that it is much more than a mere suggestion, but he asks that it be given the consideration which such an important subject deserves, especially as it is based upon scientific principles and its perfection and adoption may remove a constant source of danger from ocean voyages.

"It is well known," he says, that any object, when its temperature is higher or lower than that of the surrounding atmosphere, will either send forth heat radiations or absorb heat from its surrounding medium. If we can construct an apparatus which is acted upon by heat radiations, and if the apparatus be of such sensitiveness that it will intercept and indicate them, even if they be exceedingly weak, we need not depend upon our ear or eye to locate the source of danger. A modification of the thermopile or the radiophone may be employed for this purpose."

The instrument suggested by Mr. Herberts consists of two thermopiles, each provided with a funnel for collecting the heat rays. The funnels point [illegible] of the horizon is swept twice in every revolution of the pair. The [illegible] vanometer scale and with a local circuit provided with call bells. If a [illegible] given quarter, its heat radiations are caught in the revolving funnels every time they swing past the ship, and as she draws nearer, the strength of the current set up in the thermopile increases until the alarm bell is rung. By means [illegible] tion indicator, an observer is able [illegible] direction of the approaching ship. The increasing or diminishing action of the thermopile tells whether the ship is approaching or receding. The same laws of radiation make it possible for the instrument to indicate the approach of an iceberg, and in many cases the proximity of a wreck or of land, and to enable the navigator to distinguish the nature of the obstruction.

Mr. Herberts recognizes the fact that many factors must be considered in working out this fascinating problem, such, for instance, as the modification in the temperature experienced in approaching the Gulf Stream, but these obstacles, he thinks, can all be easily overcome.

Ohio Electric Light Association.

The fourth annual meeting of the Ohio Electric Light association will be held at the West House, Sandusky, August 18th and 19th. The convention will assemble at 10:30 o'clock on the morning of August 18th, at the West House, Columbus avenue and Water street. Delegates can avail themselves of the regular excursion rate to Sandusky prevailing at this season of the year, namely, one and one-third fare for the round trip. Rooms can be secured at the West House at $2 and $2.50 per day, American plan.

Mr. E. C. Schmidt, vice-president of the association and superintendent of the Sandusky Lighting company, has arranged a programme of amusements for the ladies during the sessions of the convention, including yachting and a trolley ride to the Ohio Sailors and Soldiers' Home, and special trips to Cedar Point on Thursday or Friday evening, where there will be special attractions. On Saturday, August 20th, by arrangement of the Sandusky Lighting company with the steamer Arrow, the members of the association and their friends will be taken for a trip to the islands. The steamer will leave Sandusky at 9:40, arriving at Put-in-Bay at 11:30, where members can get dinner at the Hotel Victory. On the return trip the members can leave Put-in-Bay either at 3 p. m. or 6:30 p. m., arriving at Sandusky at 4:45 and 8:15 respectively. The return trip in the evening will be by the south channel, passing the Hotel Victory, Catawba Island, Lakeside and Marblehead.

Following is the list of papers to be read and discussed during the convention:

"Positive and Negative Economies in Small Central Stations," by E. P. Roberts, M. E., of Cleveland.

"Some Suggestions Relative to Determining the Cost of Electrical Supply," by M. E. Turner of Cleveland.

"The Meter's Relation to the Dividend," by Caryl D. Haskins of Boston.

"Comparative Commercial Qualities of Old and Modern Transformers as Applied to an Exchange," by J. H. Perkins of St. Louis.

"Long-distance Transmission of Power," by E. J. Berg of Schenectady.

The following topics will also be discussed:

"What are the advantages and disadvantages of enclosed arc lamps for outside lighting?"

"Can the candle power of arc lamps be accurately determined by the use of a portable photometer?"

"In what way can competition of the gasoline incandescent burner be most successfully met?"

"Is it advisable for a plant to change from 15,000 volts alternating single-phase to 7,200 two-phase if no question of motor business is concerned?"

"What are the types and makes of engines in use in the smaller plants of the association; the time of their installation and their condition at the present time?"

The officers of the association are: President, H. K. Wood, Piqua; vice-president, Emil C. Schmidt, Sandusky; secretary and treasurer, Samuel Scovil, Cleveland; executive committee, John I. Beggs, Cincinnati; B. P. Holmes, Youngstown; B. P. Foster, Norwalk; George Matt, Lancaster; E. H. McKnight, Middletown; advisory committee, J. Gwynn, Steubenville; A. W. Field, Columbus; D. S. Gaskill, Greenville; finance committee, John H. Miller, Springfield; J. I. Cooke, Ironton; Edward F. Gwynn, Delaware.

Pacific Cable.

In view of the recent action of the Hawaiian government in granting a franchise to an American syndicate for cable landing privileges, subject to the approval of the United States, it will be interesting to follow the movements of the promoters of the all-British cable project.

The following is an extract from the London Morning Post: "The report of the committee which sat to hear evidence nearly two years ago on the subject of the Pacific cable still remains pigeon-holed at the Colonial Office. At the desire of the colonial premiers last June, the discussion of the report was deferred until they had time

to consider its contents. Twelve months have passed, and nothing has transpired to show that the report has even been before the colonial cabinets. Surely the time has come when official etiquette would not be infringed by making public the report in question. A great deal of fuss was made at Ottawa about the Pacific cable, and much pains were taken to get the best evidence, but it is useless to treat an imperial subject in this way. If the cable is a necessity let us know it; if not, then let the subject be dropped, but do not let the whims of the Australian premiers keep back the publication any longer. As a rule Canada is very anxious to proceed with her proposals, but in this matter of the Pacific cable the Canadian government appears quite satisfied to let things slide. What, too, is to be done about the Cape and Australian cable? That project seems also to have lapsed. Another matter of imperial interest which seems to be fading away is the question of the fast Atlantic service between Canada and the mother country. There was much discussion and a certain amount of public movement in both countries in regard to this fast service, but since the question of contract was settled the scheme seems to have lacked attention."

Concerning the survey for the projected Pacific cable route, which was called for 10 years ago by the imperial and colonial conference, the following extract from the Geographical Journal, which publishes a summary of the British Admirality surveys during the year 1897 is interesting: "In the Pacific one of the surveying vessels made an extensive cruise to Honolulu, via Palmyra and Fanning Islands, to search for reported shoals, survey islands and obtain soundings at the same time, which would be useful for a Pacific cable. Lines of soundings were carried from Sydney to Fiji, Fiji to Sydney Island to Palmyra Island, and northward to a position about 150 miles southward of the Sandwich Islands; also from a position about 360 miles southeast of the Sandwich Islands to Fanning Island and Suva. Between Suva and Auckland, a meridian distance was carried, also a line of soundings run to the eastward of former lines en route. From Auckland soundings were taken to North Cape and thence to Hobart. During this cruise Palmyra Island and anchorage was surveyed. Fanning Island was surveyed, the soundings being carried out to a sufficient distance to delineate the 1,000 fathoms' contour line, also plans made on large scales of English harbor and whaler anchorage." The London Electrical Review says that along the routes surveyed the soundings show that there is no difficulty whatever as regards depth to be expected in cable laying, not only between Fiji and Fanning or Palmyra Islands, but also along any one of the proposed routes from Australia or New Zealand, to Fanning Island or Palmyra Island.

The London Daily News on August 4th announced that "an informal conference was recently held in London between Lord Strathcona and Mount Royal, Mr. Mulock and some Australasian gentlemen who are going, we believe, to be concerned in the Pacific cable; and it is reported that the Dominion Parliament is now disposed to support the scheme."

It is announced that the contract for laying the Pacific cable has been awarded by the American company, but this interesting bit of news lacks official confirmation.

American Street Railway Association.

Arrangements have been perfected for the meeting and exhibition of the American Street Railway association, which will open at Boston on September 6th and continue through September 9th, and it is expected that this year's gathering will prove not only enjoyable but prosperous as well. There will certainly be a large western delegation, as arrangements have already been made for special accommodations between Chicago and Boston. The Wabash railroad announces that the Continental limited, which will leave Polk street depot at noon on Sunday, September 4th, will reach Boston on the following afternoon at 5:50 p. m. The Detroit members will join the party at 8:30 p. m., and the eastern contingent be taken on at various points. The St. Louis train joins the Chicago train, and it is therefore expected that the party will be the largest western delegation that has ever attended an eastern meeting of the association.

The local committee on entertainment has communicated to Secretary Penington the plans adopted for the meeting. The "schedule" includes the following features:

Tuesday afternoon, trip to Concord and Lexington.

Tuesday evening, reception at the hall.

Wednesday morning, ladies to be taken to points of local and historic interest.

Wednesday afternoon, excursion down the harbor with clambake at Nantucket Beach.

Thursday morning, drive through the park for the ladies.

Thursday afternoon, trip to Plymouth.

Thursday evening, banquet.

Friday morning, shopping trip for the ladies, visiting principal stores.

Friday evening, trolley excursion to Norumbega Park.

Following is a list of the concerns which have been awarded space at the exhibition to be held in conjunction with the meeting:

	Feet.
Street Railway Journal, New York	300
Street Railway Review, Chicago	300
H. W. Johns Manufacturing company, New York city	300
General Electric company, Schenectady	3,000
J. F. McKoy, Chicago	100
Harold P. Brown, New York	200
Walker company, Cleveland, O	1,000
Electrical Review Publishing company, New York	100
Taunton Locomotive company, Taunton, Mass	1,080
Ohio Brass company, Mansfield, O	300
Wells & French company, Chicago	400
R. D. Nuttall company, Allegheny, Pa	200
American Railway Supply company, New York	100
Adam Cook's Sons, New York	100
Weber Railway Joint Manufacturing company, New York	100
E. T. Burrows company, Portland, Me	150
Charles Scott Spring company, Philadelphia	200
International Register company, Chicago	200
William Wharton, Jr., & Co., Philadelphia	500
F. H. Newcomb, Brooklyn	100
Meaker Manufacturing company, North Chicago, Ill	200
Pratt & Letchworth company, Buffalo	200
Samson Cordage Works, Boston	100
Sterling Supply and Manufacturing company, New York	400
Adams & Westlake company, Chicago	300
Consolidated Car Fender company, Providence, R. I	400
Westinghouse Electric and Manufacturing company, Pittsburg	1,000
Rochester Car Wheel Works, Rochester, N. Y	600
A. O. Marston, Boston	100
Creaguead Engineering company, Cincinnati, O	200
Barbour Stockwell company, Cambridgeport, Mass	300
Standard Underground Cable company, Pittsburg	100
New York Car Wheel Works, Buffalo, N. Y	400
Pennsylvania Steel company, Steelton, Pa	250 or 300
William F. Ellis, Boston	200
Cleveland Frog and Crossing company, Cleveland	800
Boston Artificial Leather company, Boston	100
Peckham Truck company, New York	1,000
Pettingell-Andrews company, Boston	450
J. G. Brill company, Philadelphia	1,400
Johnson company, Lorain, Ohio	1,000
Ornamite Veneer company, New York	400
Frank Ridlon company, Boston	100
Cambria Iron company, New York	100
Van Wagoner & Williams Hardware company, Cleveland	100
Railway World, London, England	100
John Stephenson company, New York	100
Ashton Valve company, Boston	100
Baltimore Car Wheel company, Baltimore, Md	400
Hampden Corundum Wheel company, Brightwood, Mass	400
Ham Sand Box company, Troy, N. Y	100
R. H. Derrab, Boston	100
Bibber-White company, Boston	200
E. F. de Witte company, Lansingburg, N. Y	100
Taylor Electric Truck company, Troy, N. Y	800
Pantasote company, New York	200
Thayer & Co., Boston	200
American Rail Joint and Manufacturing company, Cleveland	100
Springfield Manufacturing company, Bridgeport, Conn	330
Pennsylvania Car Wheel company, Pittsburg, Pa	400
Barney & Smith Car company, Dayton, Ohio	450
J. E. Miles, Boston	100
Christensen Engineering company, Milwaukee, Wis	260
Elmer P. Morris, New York	1,080
Corning Brake Shoe company, Buffalo, N. Y	100
Pearson Jack company, Boston	100
C. F. Orr & Co., Chicago	100

It will be seen that the leading manufacturers of street-railway apparatus will be well represented at the exhibition. Already 24,750 feet has been secured for exhibition purposes, and the number of exhibitors has reached 68. This is sufficient guarantee of the success of the exhibition.

Electric Reefing and Dredging in New Zealand.

In the Otago district of New Zealand there are a number of electric power installations in connection with reefing work, and there has also been installed a large dredger worked by electricity. Most of the steam dredgers used in this extensive district carry an electric-lighting plant. At the present time more than 100 dredgers are at work in Otago province alone, and nearly all are conveniently situated for coal supply. In some parts of the province coal is very cheap at the pit's mouth, but outside of the neighborhood of the coal pits coal is extremely dear. At Queenstown £7 per ton is paid for household coal, £6 of which is paid for freight for the last 30 miles of the distance covered; 17s. 6d. per 200 pounds is paid for smithy coal. Freight rates are excessive. During the last 12 months, there has been a large increase in the number of dredgers at work, and in most instances the results have proved very satisfactory, the dredger known as "Electric No. 1," on the Molyneaux, having obtained as much as 658 ounces of gold in five days, and, according to later reports, the average return of the dredgers per week has been little short of 100 ounces.

CORRESPONDENCE.

New York Notes.

New York, August 8.—The preliminary work for the Third Avenue Railroad company's change of motive power is well under way. Last week the state railroad commissioners granted the application of the company for permission to change the power on all its cable roads to electricity, applied by the medium of underground conduits. With this permission the commissioners say: "The board does not at this time pass upon that part of the application which asks that approval be given to the use of compressed-air motors and storage batteries in addition to underground electricity. In in the future when the company is ready to use either or both of these powers, whether on the same portions of railroad on which underground electricity is used, or on separate portions, it may apply to the board for approval in each case."

An interesting instance of the benevolence of an electric-railway man of Brooklyn, whose name is not given, is related in the Tribune. That journal is active in furthering the "fresh-air" work for poor city children. Usually the little ones are taken out of the city to the refreshing air of the country, but in this case electricity was called into play to bring fresh air to a sufferer in the city's heat. 'We had heard of the illness of a woman and her little one," said the fresh-air man, "and that there was little hope for the recovery of the mother. Everybody felt sorry, and all sorts of plans were suggested for making the poor woman more comfortable. Baskets containing dainties were sent, and boxes and bundles of more dainties followed. I proposed fresh air, and went to work at once to secure it. I had a wire run from the electric line near our house, in Monroe place, to the sick chamber, had an electric fan placed at the foot of the invalid's bed, and my fresh-air scheme reduced the patient's temperature in a short time, and the doctor thinks it may have had much to do with her improved condition. There must be many places in this large city during the extreme weather where a similar gift would do much good, and for that reason I am anxious to have people know about my 'fresh-air' scheme."

The Edison Electric Illuminating company is the sole bidder this year for the contract for electric lighting in the borough of Brooklyn. The consolidation of the Edison and Kings County companies a few weeks ago disposed of all competition.

Reports of damage from electric storms are frequent this month. From Gouverneur, up in St. Lawrence County, comes news of a thunder-storm on Friday, one of half a dozen in a week, causing a loss of $20,000 by fire. There was one fatality. William H. Johnson, aged 19, was caught out in the rainstorm, and was afterward standing in the door of his home when the lightning struck a telephone pole. The current ran along the wire into the house, and jumped three or four feet from the wire and killed him. His mother was standing within three feet of him at the time and was not harmed. Telegraph and telephone lines were considerably damaged by the storm. M. S.

Northwestern Notations.

Minneapolis, August 6.—The franchise intended for W. T. Baker, the projector of a system for supplying consumers of electricity at Seattle, Wash., is said to be exactly like that granted by the city of Buffalo, N. Y., to the company now using Niagara Falls.

It has been agreed by the city fathers of Chippewa Falls that the Chippewa Valley Electric Railway company may have until September 1st to construct the trolley line.

Judge Moer of Duluth ruled that the general order of Superintendent Herbert Warren of the Duluth street railway, compelling employes to wear their full uniform in order to ride free, need not be obeyed; that only the badge was necessary. The court sustained the rule prohibiting the employes from eating lunches in the cars.

Superintendent Smith of the St. Paul street railway has made a great record for promptness and energy in hastening the completion of the new line taking the place of the cable line on Fourth street. The simple but effective method of ascending the steep hill is viewed with great comfort by patrons.

Cars for the interurban between Chippewa Falls and Eau Claire are now being built, and the line may be completed by August 15th. About four miles of track has been laid. The power plant is located in Eau Claire.

As in the case against the gas and water company, Judge Cant of Duluth decided that the franchises of the Hartman General Electric company and the Duluth Water and Light company and West Duluth Electric companies were taxable as personal property. The judgments entered in each case are the amounts asked for by the county.

Believing that fires result from defective wiring, the city attorney and deputy of Lincoln, Neb., are considering an ordinance controlling the "electrical business." The Omaha ordinance seems to be regarded with favor as a model, and it is proposed to make the electrician who does the city's work the inspector.

Hurley, Wis., citizens are inclined to believe that work will soon commence on the electric-line extension to Montral.

It is reported from Hubbard, Ia., that the Iowa Falls Electric Light company is planning to remove its plant nearer the center of town and add a steam-heating plant.

The village of New Paynesville, Minn., is getting bids for a waterworks and electric plant, using steam.

At Fond du Lac, Wis., the Central Operating and Construction company has been incorporated to furnish gas and electric lights, with a capital of $25,000. M. S. P.

PERSONAL.

Electrical people, especially those of the street-railway branch of the business, will be interested to learn that City Passenger and Ticket Agent F. M. Byron has been appointed to succeed the late assistant general passenger agent, C. K. Wilber, of the Lake Shore Railroad company. Mr. Byron had been Mr. Wilber's "right-hand man" in almost every matter appertaining to the western passenger business of the Lake Shore system. Mr. Byron, until his recent appointment, was located at the Clark

street office of the Lake Shore railroad, where his energetic and courteous manner of pushing the interests of his road became well known to its many patrons. Mr. Byron's office is now at the Van Buren street station of the Lake Shore railway, and he has the title of general western passenger agent.

ELECTRIC LIGHTING.

Mr. Albertz, owner of the electric plant at Cloverdale, Cal., has signified his intention to reconstruct the plant which was destroyed by fire four months ago.

The Redlands (Cal.) Electric Light and Power company has decided to increase its capital from $200,000 to $500,000, and to issue bonds to increase the bonded indebtedness from $100,000 to $400,000.

The new plant of the Tehama (Cal.) Electric company was put into operation for the first time last month. The plant is the property of James Cross of San Francisco. Two more dynamos will probably be put in soon.

O. M. Kirlin and another of Watertown, S. D., have just been granted a 20-year franchise for electric lighting in that town. They intend to give all-night service from a first-class plant. Machinery and supplies will be required.

Robert C. Morris and associates have secured from the City Council of New Orleans a franchise to enable them to erect and operate an electric-light and power plant in that city. It is said that Mr. Morris is backed by ample capital. He proposes to spare no expense in the equipment of an efficient, economical and thoroughly up-to-date plant.

The electric-light plant of Livingston, Mont., was totally destroyed by fire recently. The building was a stone structure and was equipped with improved machinery. The loss was $32,000; insurance, $24,600. As soon as the insurance is adjusted the work of replacing the plant will be begun. The electric-light plant is the property of the Livingston Water Power company.

ELECTRIC RAILWAYS.

A New York syndicate has been organized to undertake the management of the Lima, Peru, street railways. It is probable that electric lines will be established.

The county commissioners have granted a franchise to the Kansas City and Leavenworth Rapid Transit company of Kansas City, Mo., to build an electric trolley road.

The Tippecanoe Electric Railroad company of Monticello, Ind., was recently incorporated, with a capital of $50,000 to build an electric railroad. Charles C. Spencer of Monticello is a director.

It is reported that a New York syndicate is considering the plan of constructing a line to connect with the West End railway and the Savannah (Ga.) and Isle of Hope railway. The new line will be about nine miles long.

It is stated that Norton & Turnstall of New York will finance the proposed connecting line of 27 miles from Kalamazoo to Battle Creek, to be built by the Michigan Traction company. Preliminary surveys have been made on the line.

The New York State Railroad Commission granted the application of the Peekskill Traction company for permission to construct an electric street railroad in Peekskill. The road will run to the state camp and thence to Verplanck's Point.

The directors of the Central Traction company of St. Louis have voted to increase the capital stock from $100,000 to $5,000,000. The Municipal Assembly recently passed an act giving the company a franchise covering many streets. R. M. Snyder, president of the Mechanics' Bank, Kansas City, Mo., and John H. Blessing of St. Louis are interested in the company.

Quincy's entire electric street-railway system was sold on August 5th to a Maine syndicate, represented by W. B. McKinley of Chicago. The same syndicate controls street-car systems and light plants in Joliet, Bay City, Champaign, Springfield, Ohio, Trenton, Mo., and other cities. The syndicate will at once spend $100,000 for extensions and rolling stock. Capitalists in the same syndicate expect to close deals for the gas works and electric-light plant within a few weeks.

In relation to the suggested consolidation of the adjoining and intermingled electric-railway systems of the Calumet Electric Street Railway company, South Chicago City Railway company and Chicago Electric Traction company, the Economist says: "The highest value of the properties would probably be found by operating them as a unit as a feeder to a trunk line, either the City Railway or the South Side Elevated. When a proposition to sell the Calumet Electric to the City Railway was tentatively broached soon after the failure of the National Bank of Illinois, there was a very wide difference in the respective ideas as to the value of the property. The Chicago Traction company could find the money to buy the two other companies if it desired to do so, but probably the experience of the storage-battery people in street railroading on the South Side has not been of the sort to make them enthusiastic about getting hold of more property of that kind. It can be said with authority that no definite, practicable proposition for a consolidation of the companies named above has as yet been presented."

TELEGRAPH.

The Postal and Western Union companies are at odds about the telegraphic rights along the line of the Cairo and St. Louis railroad. The older company claims the exclusive right to operate a telegraph line along the railroad, while the Postal company has petitioned the state railroad and warehouse commissioners for an order to compel the railroad company to distribute material for the construction of a new telegraph line along the road.

During last year 156 miles of new lines were added to the telegraph system of Guatemala, bringing the total mileage up to 3,093 miles with 151 stations. In all, 644,169 telegrams were dispatched, of which 479,371 were private, against 755,682 telegrams in 1896, a decrease of 91,513. This decrease was almost entirely in private telegrams. There has been a considerable falling off in the imports of railway and telegraphic material. In 1896 the United States supplied this class of goods to the value of nearly $350,000, Great Britain $172,500, and Germany $165,000. In 1897 the total value was about $225,000 only, of which the United States supplied $145,000, Germany $55,000, Belgium $20,000 and Great Britain only $5,000.

Considerable amounts of the stock of the Chicago and Milwaukee Telegraph company, which operates an independent line between Chicago and Milwaukee, have been bought by the Chicagoans interested in a system of tickers. A. McD. Young, president of the telegraph company, had this to say of the transaction: "It is not a sale of the line, but a lease to a syndicate in Chicago for a term of 20 years at a price satisfactory to the company. The syndicate will operate it under the lease, but will not own it, and the officers of the company will remain the same." The Chicago and Milwaukee Telegraph company was organized 18 years ago by Milwaukee grain merchants, bankers and other business men, and its capital stock is $25,000.

TECHNICAL SCHOOLS.

The sixth annual meeting of the Society for the Promotion of Engineering Education will be held on August 18th, 19th and 20th at the Massachusetts Institute of Technology in Boston. Dr. R. H. Thurston will address the society on "The Correct Theory and Method of Organization and Conduct of Professional Schools." In the programme of papers for discussion there are two papers on distinctively electrical subjects—"The Study of Electricity in Courses Other than Electrical," by J. P. Jackson, and "Laboratory Instruction in Electrical Engineering," by R. B. Owens.

ELECTRICAL SECURITIES.

The Laclede Gas Light company reports net earnings for July of $55,596, an increase of $796 as compared with the same month last year. For seven months ended in July the net earnings were $504,594, an increase of $50,553 as compared with the corresponding period last year.

The gross earnings of the Brooklyn Heights railroad, including the Brooklyn, Queens County and Suburban and the Sea Beach roads, for the month of July is reported as $560,520, an increase of $88,680 over the same month last year. The total income for the month was $572,116, an increase of $82,653.

The Bridgeport Traction company reports gross earnings for June of $33,018, an increase of $5,273 as compared with the same month of last year, and net $18,968, an increase of $6,107. For the year ended June 30th the gross earnings were $333,408, an increase of $14,434 as compared with the corresponding period of last year, and net $155,221, an increase of $27,394. The fixed charges were $85,950, leaving a surplus of $69,271, an increase of $25,594.

The Long Island railroad reports gross earnings for June of $481,799, an increase of $9,164 as compared with the same month of last year, and net $208,640, an increase of $11,083. For the year ended June 30th the gross earnings were $4,683,956, an increase of $354,385 as compared with the corresponding period of last year, and net $1,449,594, an increase of $151,614. The taxes and charges were $1,365,893, leaving a surplus of $213,569, an increase of $172,518.

There have been placed on the market $30,000 Middletown (O.) Electric Light and Power company first-mortgage six per cent. gold bonds at 101 and interest. The company was organized in 1894 with a capital of $40,000, and is the only electric-light plant in the city, which has 12,000 inhabitants. The company has a 10-year contract with the city for street lighting, for which it receives $9,706 a year. In addition to the city lighting it operates 53 commercial arc lights, 3,800 incandescent lights and supplies power to several manufacturing companies, also to other business houses for running small motors and fans. The cash receipts for 1897 were $17,235.30, the operating expenses, including taxes, insurance and all expenses of management, were $10,354.63, leaving $6,880.67 with which to pay interest on the bonds, amounting to only $2,160.

MISCELLANEOUS.

The burying of the electrical wires [illegible] space in Los Angeles, Cal., and the entire work is expected to be completed by October 15th, at a cost of $500,000.

There is a law on the statute books of Buenos Ayres, Argentine Republic, prohibiting the erection of overhead electric-light cables, and the authorities have decided to rigidly enforce the regulation.

Under the tariff of Jamaica, which will be in effect until April 30, 1899, apparatus and appliances of all kinds for generating, storing, conducting, converting into power or light and measuring electricity are placed on the free list.

It is said that the government of Victoria proposes to substitute iron and steel in place of wood for the 80,000 telegraph poles now erected in the colony. Provision for the first installment of 5,000 posts has already been made in the estimates for the next fiscal year.

TRADE NEWS.

James H. Mason of New York has issued an illustrated catalogue containing electrical information. A copy can be had on application.

The Schoenhofen Brewing company of Chicago has ordered from the Ball Engine company of Erie one 100 horse power engine, direct-connected to a Western Electric dynamo.

The large order of Walker alternators for the Union Carbide company of Chicago, recently noted in the Western Electrician, has been duplicated. The order, as it now stands, comprises over 20,000 horse power in generators and is said to form the largest contract for electrical machinery of any kind ever awarded. The shops of the Walker company in Cleveland are running night and day on existing orders, and the recent large additions to the plant will be taxed to their utmost to put out the immense amount of work already in hand.

Two interesting news items come from the shops of the Westinghouse Machine company. One is that the company has built a 650 horse power gas engine, having three cylinders, each 25 inches in diameter and 30-inch stroke, and operating at 145 revolutions per minute. The other is the exhibition of a Parsons steam turbine, driving a 200 horse power alternator. The turbine on exhibition runs at 4,700 revolutions per minute without any perceptible vibration. This speed, however, is not limited in any way. It may be either higher or lower. The bearings, which are a special feature, admit of any rotative speed that may be desired.

The new works of the Warren-Medbery company, manufacturer of inductor alternators, Sandy Hill, N. Y., are now running to their utmost capacity, day and night, in order to fill the orders for its apparatus. The company's business has increased over 100 per cent. within the last 60 days, the demand for inductor machines reaching beyond the utmost expectation. The company has recently made a large addition to its works, and new machinery is now being installed, and it hopes to be able soon to meet all demands made upon it for alternators. It is also manufacturing a full line of standard white marble switchboards and the Medbery and Standard switches, which are well known. The Medbery insulation and overhead equipment for electric railways is now being manufactured by this company, which is prepared to furnish this high-grade material promptly.

BUSINESS.

The Stromberg-Carlson Telephone Manufacturing company, Chicago, announces a divided-circuit toll-line telephone system that is claimed to be entirely clear from the broad claims of the Carty patent on the bridging system, recently upheld as valid in Pennsylvania. The system is said to have some new and improved features as compared with the regular bridging or series system.

Like all the Westinghouse publications, "Electricity for Machine Driving"—a pamphlet pointing out the advantages of electric power—is handsomely printed and illustrated. Tables and statistics showing the loss of power in belts and shaftings are given, and factory owners who realize this wastefulness and seek to modernize their plants are invited to seek information at the nearest Westinghouse office. The pictures show Tesla motors adapted to different types of machinery.

The New England Sanitary Product company is erecting, at Old Harbor Point, Mass., near Boston, an absolutely fireproof building, 120 feet wide and about 130 feet long. The building is two stories high, and is of skeleton-steel framework style, consisting of steel columns built in the walls, carrying heavy steel floor beams and girders, and clear span-roof trusses, which support the roof. The structural steel work in this plant was designed and is being furnished and erected by the Berlin Iron Bridge company of East Berlin, Conn.

The very interesting product of the Montauk Multiphase Cable company of New York has been fully described in the technical journals of this country, and it is pleasing to learn that it is also attract-

ing attention in far-off Australia. The following mention of it appeared in the Williamstown Advertiser of July 2d: "Mr Kirkby has introduced the Montauk multiphase fire cable into the colony, and it was submitted to a highly satisfactory practical test for the first time in Australia yesterday. It is a most ingenious invention, and Mr. Kirkby is so satisfied with it that he has taken the responsibility of recommending it to Mr. Stein, superintendent of the Metropolitan Fire Brigade, and will introduce it to the big mercantile houses in the city. The cable can be attached to an ordinary electric bell, to a telephone and to the fire alarm. The great and peculiar property possessed by this cable is that when it is ignited it will instantly ring a fire alarm on any premises where Mr. Kirkby's automatic fire alarm is connected with it. Mr. Kirkby is convinced that if this cable had been used in Melbourne recently the great fire at which damage to the amount of nearly one million sterling was done would have been avoided."

ILLUSTRATED ELECTRICAL PATENT RECORD.

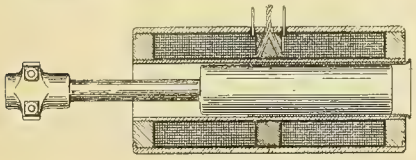
Issued August 2, 1898

608,175. Reciprocating Electric Drill. Herman Casler, Canastota, N. Y. Application filed March 18, 1898.

Energizing coils contain a magnetic core and are enclosed in a casing composed of an exterior shell, heads or ends and an interior lining tube, all of iron or steel, the lining tube and heads being brazed together.

608,211. System for Heating by Electricity. James F. McElroy, Albany, N. Y. Application filed November 16, 1892.

Several heaters consisting respectively of a plurality of heating sections and single heaters consisting of but one heating section are so connected that the single heaters may be placed in either circuit, in which the heating sections in the heaters containing a plurality of heating sections may be placed, with means for varying the connections.



NO. 608,175.

608,228. Galvanic Bath. Carl E. Schnée, Carlsbad, Austria-Hungary. Application filed September 14, 1897.

A galvanic bathing apparatus is composed of upper and lower tubs, insulating bases for supporting the same, a pair of electrodes projecting into each of the tubs, wires connecting the upper tubs and leading to the negative pole, and wires connecting the lower tubs and leading to the positive pole of a source of electric energy.

608,234. Insulating Caster and Electric Switch Combined. Augustus W. Slayton, Tecumseh, Mich. Application filed May 18, 1898.

The wheel of the caster is made of glass combined with a metallic contact arm pivotally secured to the metallic frame or support of the caster and adapted to form an electric connection with the floor.

608,246. Electrical Signaling Apparatus for Transmitting Commands. Conrad Arldt, Berlin, Germany. Application filed December 29, 1897. Patented in England May 7, 1897, and in France May 7, 1897.

This apparatus comprises a transmitting instrument, which is a closed wire coil, two diametrically opposite rotatable contacts supplying current thereto, three leads connected to the coil at points 120 degrees apart and a receiver consisting of three coils connected to the leads and acting upon a central rotatable magnet having a pointer whereby variation of resistance in the transmitter caused by the change of position of its rotatable contacts will effect the movement of the pointer in the receiver to the corresponding position quite independent of any variations in the tension of the current supplied.

608,249. Alternating-current Induction Motor. Charles S. Bradley, Avon, N. Y. Application filed October 22, 1895.

An alternating-current motor is provided with two independent field magnets wound to develop rotary magnetic fields, and two armatures of relatively high and low resistance co-operating with the fields.

608,258. Electric Bond for Railway Rails. Samuel H. Harrington, New York, N. Y. Application filed December 10, 1896.

The first claim is given: In an electric bond for railway rails the combination of an iron or steel rail having a perforation formed in its web at an acute angle to the plane of the web with a bond ferrule formed of metal having greater conductivity than the metal of the rail, said bond ferrule being inserted in and brought into close contact with the sides of the perforation in the rail web, and a bond body also formed of metal of greater conductivity than that of the rail, said bond body being inserted in the ferrule.

608,269. Electric Arc Lamp. Charles A. Pfluger, Chicago, Ill. Application filed August 7, 1895.

This lamp has an upwardly projecting portion provided with an enlarged end with a fixed hanger, downwardly projecting tubes and means for interlocking the tubes, each at its extremity to its opposed part, and a fixed part associated with the tubes and provided with a recess or aperture of such size as to receive the upwardly projecting portion of the lamp, but not to permit the passage of the enlarged end, the lamp being supported by the engagement of the enlarged end with the fixed part.

608,277. Armature for Dynamo-electric Machines. Edward H. Anderson and David P. Thomson, Schenectady, N. Y. Application filed January 8, 1898.

This armature is provided with two main paths for the field flux, as distinguished from the several paths through the armature teeth, which have practically the same magnetic reluctance, but which with a given field excitation work at different densities.

608,281. Trolley. Frank E. Case, Schenectady, N. Y. Application filed June 30, 1897.

In a trolley there is the combination of a base, a combined lifting and buffer spring extending in one direction only from the base, and a pole socket pivoted to the base at a point below the center line of the spring.

608,300. Electrolytic Apparatus. John G. A. Rhodin, Eccles, England. Application filed August 11, 1897. Patented in England September 29, 1896.

The outer vessel, having a ribbed or corrugated bottom, contains the rotating vessel, a plurality of tubular projections depending from the bottom of the inner receptacle and dipping into a mercury cathode, a series of anodes extending through the upper transverse wall of the interior vessel with their lower ends depending into the tubular projections, and a suitable conducting substance encircling the upper ends of the anodes above the transverse wall.

608,301. System of Train Control. Edwin W. Rice, Jr., Schenectady, N. Y. Application filed December 31, 1897.

Motor cars are coupled in a train, having a proper equipment of motors and controlling devices such that each motor car may, if desired, be independently operated, and switches are provided by which the complete motor equipments may be thrown in series or parallel with each other, and simultaneously regulated when in either connection by one of the motor controllers.

608,302. System of Train Control. Edwin W. Rice, Jr., Schenectady, N. Y. Application filed March 26, 1898.

The combination is claimed with a master controller, of a motor controller, a pilot motor driving the motor controller, and electrical means, controlled by the master controller, for interrupting the supply of current to the pilot motor in such a way that the motor controller can stop only in the off position or in some definite running position.

608,307. Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed July 14, 1894.

The method of supplying polyphase current from a plurality of windings, whose phase relation is otherwise undetermined, consists in so connecting the windings that their mutual reactions will establish and maintain a polyphase relation between the electromotive forces generated therein, and carrying current from a plurality of the windings to feed the polyphase translating device.

608,308. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y. Original application filed July 14, 1894. Divided and this application filed May 22, 1897.

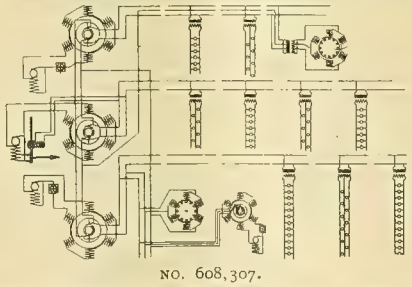
The method of producing polyphase currents consists in generating single-phase current, driving by the single-phase current a plurality of alternating motors in series, and maintaining by the mutual reactions of the machines a polyphase relation between the electromotive forces of the system.

608,309. Regulating Dynamo-electric Machines. Charles P. Steinmetz, Schenectady, N. Y. Application filed April 23, 1898.

The method of operating a dynamo-electric machine consists in causing the saturation curve of the machine to bend at a flux value lower than that at which the bend would normally occur, and operating the machine on that part of the curve above the bend.

608,319. Electro-mechanical Lock. Henry G. Carleton, New York, N. Y. Application filed September 9, 1897.

The combination with a door lock and an electric circuit for operating the same, of a hand-operated combination mechanism in the circuit comprising a rotative disk inside the door and a member yieldingly coacting with the disk so as to resist step by step its movement and thus indicate the position of the combination mechanism.



NO. 608,307.

608,320. Electric Combination Lock. Henry G. Carleton, New York, N. Y. Application filed April 4, 1898.

The last claim is given: In a protective device for combination locks the combination with one of the plates of the lock casing, of a protective plate, insulation between the plates, a screw holding the plates together, said screw having a tapped portion and a reduced portion, the tapped portion engaging one of the plates and being long enough to span the distance between the plates and a recessed portion lying in the perforation of the other plate when the screw is home, an insulating washer between the head of the screw and the plate, the plate and the casing being connected to a suitable source of electrical energy, and an alarm in said connections.

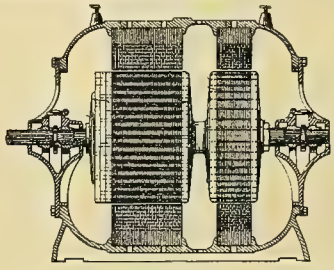
608,321. Electric Lock. Henry G. Carleton, New York, N. Y. Application filed May 24, 1898.

There is the combination with a movable magnet of one of the engaging parts of the lock, such as the latch or keeper, the attractive force of the magnet being made effective upon the engaging part, whereby a movement of the magnet will cause a corresponding movement of the latch or keeper.

608,322. Combination Mechanism for Electric Locks. Henry G. Carleton, New York, N. Y. Application filed June 18, 1898.

The circuit-controlling mechanism and a disk carrying a series of indicating devices suitably spaced apart for indicating successive positions of the circuit-controlling mechanism are provided, that one of the series which indicates the initial position of the circuit-controlling mechanism being farther from the adjacent indicating devices than the other devices of the series are from each other.

608,333. Telegraphic Transmitting and Receiving Apparatus. Bernhard Hoffmann, Paris, France. Application filed May 5, 1897. Patented in Luxemburg March 20, 1897.



NO. 608,249.

In a printing telegraph comprising transmitting and receiving instruments each having a type wheel rotated intermittently through an escapement, which in turn is controlled by an electromagnet in connection with a line circuit, a synchronizing means is devised consisting of a pole changer for reversing the direction of the current from the line battery, a polarized magnet at each instrument, a local circuit operating the escapement magnet thereof, and divided into branches controlled by the polarized magnet, a revolving brush and sector included in a synchronizing branch of the circuit, the sector interrupted by an insulated segment at the synchronizing position for breaking the circuit and stopping the instrument, and means for connecting the insulated segment in the branch circuit except at predetermined intervals.

608,340. Automatic Switch for Regulating Electric Air Compressors. Moss Moseley and Philipp Funck, Rochester, N. Y. Application filed November 15, 1897.

In combination with an electric motor and compression pump, an automatic switch controls the motor circuit, consisting of two communicating cylinders provided with pistons, suitable insulated contacts, one of which is movable, and operated by the movement of one piston produced by the admission of air to its cylinder by the movement of the other piston.

608,343. Electric Heater. James F. McElroy, Albany, N. Y. Application filed April 6, 1895.

In an electric heater there is the combination of a central core piece carrying radial arms at either end, an encircling spring placed about the arms, insulating bars placed upon the encircling springs and extending longitudinally parallel with the core piece, a resistance wound upon the insulating bars and straining the encircling springs against the tension of the wire.

608,389. Rapid Telegraphic Transmission on Cable Lines. Charles L. Davies, London, England. Application filed June 25, 1896.

An electromagnet is actuated following the closing of the key to disconnect the line from the source of electromotive force before the current from the source has risen in the line to its effective maximum.

608,412. Joint for Electric Conductors. Herbert S. Patten, Montclair, and William Maver, Jr., Jersey City, N. J. Application filed December 31, 1897.

The combination with the tubes and the insulated conductors within the tubes and connections for the conductors, of a two-part case adapted to set together around the joint and having tapering or conical ends and screw rings around the ends of the inclosing tubes and receiving and clamping together the parts of the divided case.

608,497. Electric Headlight Lamp. Harlan P. Wellman, Ashland, Ky. Application filed December 10, 1897.

An electric lamp having a parabolic reflector, a translucent elongated cylindrical casing projected at its ends through the reflector, closures over the ends of the casing, a support for the casing outside of the reflector, carbon-carrying rods extended through the closures, and carbons secured to the inner ends of the rods and located wholly within the casing.

608,504. Telephone-transmitter Arm and Its Attachment. William J. Barr, Ashtabula, Ohio. Application filed October 30, 1897.

The combination is claimed with a base having a slot or mouth, and one or more trunnions arranged within and on the side or sides of such mouth, the transmitter arm whose inner end is adapted to fit and work on such trunnion or trunnions, and a fastening device which is in the nature of a cap adapted to be secured to the arm and completing the bearing.

608,537. Battery Electrode. Henry E. Wilkinson, Mount Vernon, Ohio. Application June 10, 1897.

A battery plate constructed of resilient spring metal and provided with a pocket having a front side sloping inward toward its bottom, and ends which converge in a downward direction and are at angles to the sloping front side.

Western Electrician.

EVERY SATURDAY.

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Snoqualmie Falls Transmission.

In the middle of March the Snoqualmie Falls Power company began the work of building a plant at Snoqualmie Falls to utilize and transmit the power of the cataract to the cities of Seattle and Tacoma, Wash. At that time the Western Electrician gave a brief preliminary account of the project and a picture of the falls. Now the work is well under way, several important contracts have been let, and this journal is enabled to give further details, with pictures showing the work accomplished, of a plant which will embody several features of exceptional interest.

Snoqualmie Falls is an unbroken cataract of 268 feet in the Snoqualmie River, 22 miles east of Seattle, in an air line. Its importance as a possible source of power for use in the adjacent cities has long been realized, and the project of utilizing the power is not a new one. It was not until this year, however, that the necessary financial arrangements were finally completed and the work of building a plant actually begun.

The Snoqualmie River is formed by the union of three widely divergent forks which drain a large section of the western slope of the Cascade Mountains. The water-shed is said to be about 460 square miles in area, and the rainfall is placed at 85 inches a year. During the heat of summer the melted snow from the mountain summits keeps up the supply of water. At the lowest stages of the water the power of the falls is placed by conservative calculation at from 20,000 to 30,000 horse power. The plant now going in will have capacity to deliver 6,000 horse power of this in the cities named, after deducting all losses. Provision is also made for extension.

The cataract is a very picturesque and impressive one, and it is situated in a sparsely settled and thickly wooded country. The central view in the group of pictures on this page (Fig. 1) shows the crest and upper portion of the falls, and Figs. 6 and 7 on page 100 show the character of the country thereabouts.

Briefly stated, the plan comprises an intake in the channel of the river about 300 feet above the falls; a shaft 250 feet thereunder, with a steel pipe to contain the column of water; a large excavation at the foot of the shaft, containing a receiver for the water, water-wheels, generators, transformers and switchboard; a tunnel or tail-race, through which the water flows from the water-wheels to a portal at the lower level of the river, and an electric transmission line from the subterranean power house to the distant points of consumption.

Mr. Charles H. Baker of Seattle, who is the president of the company and its chief promoter, was in Chicago last week to place contracts for the electrical equipment of the plant and to transact other business connected with the work. He states that the shaft is nearly down to the required depth; that the rock excavation for the power-house chamber is within two months of completion and that the tunnel is finished. The shaft is 250 feet deep and eight by 25 feet in horizontal section; the chamber at the base of the shaft will be 200 feet long, 50 feet wide and 25 feet high, while the tunnel leading from it is 660 feet long 15 feet high and 15 feet wide. The rock is hard and free from fissures. The excavation is done by compressed-air drills.

A general view of the construction works is shown in Fig. 2, while Fig. 3 gives a nearer view of the air-compressing and hoisting machinery. Fig. 4 shows the interior of the tunnel and the tramway used for the dump-cars. More comprehensive views of the tunnel works below the falls are shown in Figs. 6 and 8. The former also gives a view of the long stairway leading from the upper works to the tunnel portal, while the latter shows a compressed-air pipe and a conveying cable.

The construction plant is supplied with steam by two tubular boilers of 125 horse power each. A double-friction drum and brake-hoisting engine of 75 horse power, with reversible link motion, raises 6,500 pounds from the shaft at the rate of 450 feet per minute on one drum, each drum working separately. The rock is raised on an improved safety platform cage, suspended by wire rope, of which there is 600 feet on each drum. The engine raises the rock taken from the shaft to a tower which has been erected directly over the mouth. From this tower the rock is carried by a gravity tramway to a crusher, which in 10 hours will crush 70 cubic yards to a size of 1½ inches, being operated by a 15 horse power engine. The rock is piled up for use in building the dam and intake, which will be the last step preliminary to installing the generating machinery.

The mining is done by 10 compressed-air drills, the power for which is furnished by an Ingersoll-Sergeant compressor. It draws in 960 cubic feet of air a minute and produces an air pressure of 100 pounds per square inch. The compressed air passes into an iron receiving tank, 4½ feet in diameter by 12 feet high, whence it is distributed through iron pipes down the shaft and into the tunnel.

When the excavation is completed the intake (a channel 20 feet wide and 60 feet long) will be built and a dam will be built diagonally across the stream

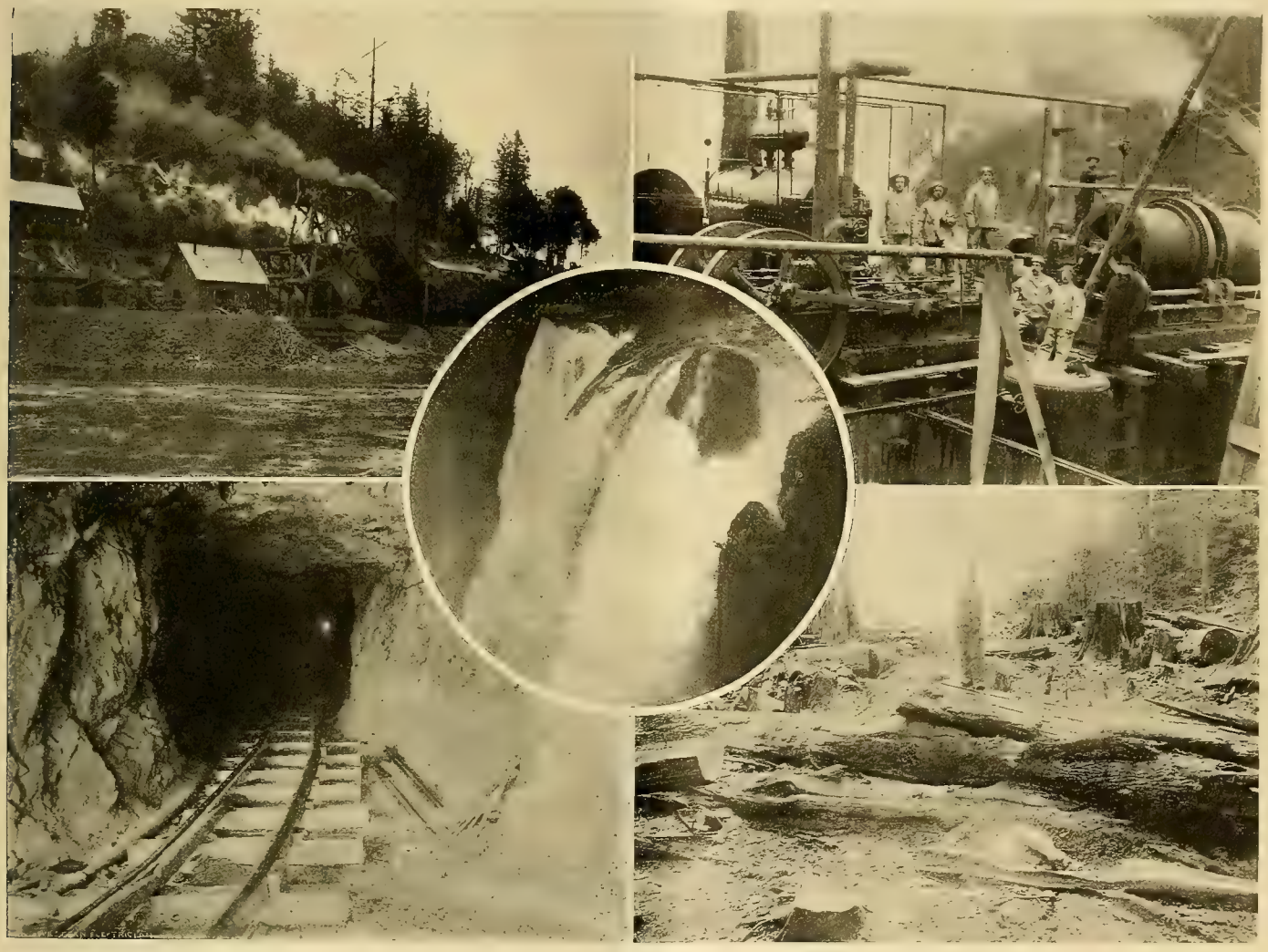


Fig. 2. General View of Construction Works.

Fig. 1. Crest of the Cataract.

Fig. 3. Construction Plant Uncovered.

Fig. 4. Interior of Tunnel.

Fig. 5. Clearing Right-of-way for Pole Line.

SNOQUALMIE FALLS TRANSMISSION.

along a ledge of rock which extends across the river at the lower edge of a pool 300 feet above the falls. This dam will maintain the water at a constant depth. It will be 450 feet long, 15 feet high, 15 feet wide at the base and eight feet wide at the top, and will be of solid concrete. Near its center will be a bear-trap dam which will be dropped to allow the escape of flood water. Five thousand barrels of Milwaukee cement have been ordered for the hydraulic work. It is said to be the plan to divert the course of the whole river through the shaft and tunnel while the dam is being built, the falls running dry. When the dam is finished the water will be again cut off from the shaft and tunnel and will return to its accustomed channel; the pipe will be set in the shaft, the elevator by which the men are to descend into the subterranean chamber will be put in place, the dynamos and water-wheels will be installed, and the wires stretched which are to carry the current to the surface.

Fig. 6. Foot of Falls and Stairway.

Fig. 7. River below the Falls.

Fig. 8. Whirlpool, Tunnel Entrance, Air Pipe and Conveying Cable.

SNOQUALMIE FALLS TRANSMISSION.

The receiver at the bottom of the water column will be tapped for four water-wheels, and each water-wheel will drive a 1,500-kilowatt three-phase alternating-current generator. These machines will be operated at 7,200 alternations per minute, and the output will have an electromotive force of 1,000 volts. The pressure will be raised by static transformers in the subterranean power chamber to 25,000 or 28,000 volts, which will be the initial line voltage. Two 125-volt exciters of 75 kilowatts each will complete the machinery equipment. All the generators, transformers, exciters, switchboard apparatus, etc., will be supplied by the Westinghouse Electric and Manufacturing company.

Aside from the exceptionally high voltage to be employed, the transmission line will be of great interest, from the fact that aluminum conductors will be used, and the plant will thus be the first in the world to use aluminum to transmit electricity to a considerable distance in commercial practice. Mr. Baker has entered into contract with the Pittsburg Reduction Works for about 500 miles of aluminum wire of No. 2 and No. 3 B. & S. gauge. This wire is pure aluminum, with the exception of about 1½ per cent. of copper. While it has only about 60 per cent. of the conductivity of copper, yet the difference in weight is so great that, for a long transmission line of this character, Mr. Johnston, the chief engineer of the Snoqualmie Falls Power company, calculates that the use of the lighter metal is advantageous, both from a financial and an engineering point of view. It is possible that, with the prevailing high price of copper, the Snoqualmie installation, if it is as successful as it is hoped, may prove to be a pioneer in an extensive use of aluminum for electrical transmission purposes.

Four circuits of three wires each will take the current from the falls to Seattle and Tacoma. Two circuits supply each city, and there are two distinct pole lines. These pole lines, composed of cedar poles cut in the vicinity and the aluminum wire, run side by side from the falls for 19 miles to Renton, where they diverge, one going to Seattle and the other to Tacoma. The length of the pole line from the falls to Seattle is about 30 miles, and to Tacoma about 44 miles. The pole lines follow, as nearly as possible, a direct line to Renton. They are on country roads wherever possible, and for a long distance run due west along section lines. In such cases a private right-of-way has been acquired, either by free gift or at a small expense. From Renton the Seattle line will follow the county road over Beacon hill to the city, and the Tacoma line will run almost due south through Auburn and Kent.

For long distances the right-of-way runs through unbroken forests of fir. A strip 25 feet wide is cleared of all vegetation, and every tree within 300 feet of each side, which could possibly strike the wires, will also be cut down, so that all danger from forest fires or windfalls will be avoided. Some of these giant firs are 300 feet high and six or eight feet in diameter. The wind has an immense leverage on these great trunks, and if one should be blown across the line it would, of course, be a serious interruption to the service. A photograph showing the clearing for the right-of-way near the falls is reproduced in Fig. 5. A pretty view showing the river below the falls and the character of the country is given in Fig. 7. The poles are from 36 to 60 feet high, according to the nature of the ground. The insulators are of the Redlands type, made by C. S. Knowles of Boston. They are of porcelain, triple-petticoated and of unusual size.

While each circuit will ordinarily carry about one-half of the power destined for the city to which it runs, it will be possible, in case of breakdowns, to carry the entire current on one circuit with an increased drop. A further precaution will be the establishment at Renton of a switching station, by which, in case of breakdown on the Seattle circuits, the current from one of the Tacoma circuits can be conducted to that city and vice versa. By linking the two lines together it will be possible to obtain an electrical circuit 150 miles long for testing. With such a circuit, aluminum conductors and 28,000 volts potential some highly important and interesting data should be secured.

At the points of consumption the potential will be reduced in sub-stations and the power will be sold to street-car companies, electric-lighting plants, flour mills, machine shops and other industries. Much of it is already under contract. Coal is not cheap in Tacoma or Seattle, and Mr. Baker declares that the company will be able to furnish power cheaper than it can be produced by any fuel and that manufacturers will take out their steam plants and install electric power.

The work is proceeding under the technical direction of Thomas T. Johnston, chief engineer, and James J. Reynolds is the superintendent of construction. Both are Chicago men, and it is Chicago capital that is building the plant. The cost of the work is estimated at $500,000, and the company is capitalized for that amount. It is hoped that power will be delivered early next year.

Niagara Power.

In the central station of the Niagara Falls Power company the work of completing the installation is moving rapidly forward. No. 5 of the 5,000 horse power dynamos is in position, which completes the number of dynamos that will be controlled by the first switchboard. The second switchboard structure has been built and the controlling devices placed upon it. The illustration presented in Fig. 1 gives an excellent idea of the progress made in this famous installation. It will be seen that one of the dynamos is going up in front of the second switchboard.

In the transformer house adjoining the power house eight of the large transformers are in place, all being of the type already described in these columns. A picture of this installation is presented in Fig. 2.

The Buffalo Railway company is now taking 2,000 electrical horse power from the Falls, and has installed another pair of converters to handle it. They are similar to those first placed. The illustrations (Figs. 3 and 4) show the converters and the switchboard.

In Buffalo the Cataract Power and Conduit company is erecting a new transformer station on Niagara street. The building will be of brick and cost $2,500. It is stated that the first to get power from this new station will be a malt-house plant that is being built at the corner of Albany and Niagara streets. This building will have a frontage of 340 feet on Albany and 220 on Niagara street. A kiln 60 feet square and 180 feet high will also be built.

FIG. 2. NIAGARA POWER.—TRANSFORMER STATION.

General Distribution from Central Stations.[1]

PART I.

Mr. Thayer, Belle Plaine, Ia.: I would like to ask Mr. Wagner two questions, one of which is in regard to the design of these extremely large transformers. Does he regard it as advisable to obtain an extremely close regulation; that is to say, a regulation within one per cent., or is it better to have a slightly poorer regulation, and more iron work? The second question is, How does he overcome the difficulty of the excessive drop in the large conductors carrying the secondary currents from the large transformers?

Mr. Wagner, St. Louis: In reply to the first question, I may call attention to the fact that I mentioned in the paper that by making the transformer practically an integral part of the feeder, we eliminate all the effects of transformer drop, just as we do our feeder drop by regulating the pressure wires from the feeder terminal, which becomes the secondary terminal of the transformer, so that we can sacrifice the regulation of the transformer to secure a very low iron loss; but I want

1. Stenograpic report of discussion following the reading of papers by Herbert A. Wagner of St. Louis on "General Distribution from Central Stations by Alternating Currents" and Louis A. Ferguson of Chicago on "General Distribution from Central Stations by Direct Currents," before the National Electric Light association at Chicago on June 8, 1898. The full text of Mr. Wagner's paper was presented in the Western Electrician of August 6, 1898, and Mr. Ferguson's on August 13, 1898.

to add that a poorly regulated transformer is very much better for use in a system where transformers are connected in multiple, provided the pressure for each transformer can be regulated independently. Transformers of very close regulation, one per cent. or under, are connected in multiple with two or three hundred feet of mains in between. Unless the resistance of the mains is extremely low, the transformer will handle the load only when it is uniformly distributed along the main. In such a case the transformer nearest the load will take practically all the load, so that for good distribution of load between the transformers poor regulation is desirable, provided that regulation does not affect in general the regulation of the system, and it may be so modified that it will not do that by making the potential of each transformer to be regulated independently by feeder regulators at the station, manually operated. The changes of loads are slow enough so that one mechanic can take care of them.

Mr. Van Trump, Wilmington, Del.: I wish to ask what is the objection to cutting the feeder transformer off the line automatically, and saving the underload losses during underload?

Mr. Wagner: The object is to make the underload losses so small that it will not be necessary to do that. That would complicate the operation of the system very considerably, both in the matter of attendance and the use of switches and automatic devices which are not, as a rule, to be depended on. In the system described here the highest efficiency is at the average load, so that if a transformer were cut out and its feeder cut out, it would decrease the average efficiency rather than raise it, as it would increase the load on the other feeders, increase the copper losses in the other feeders and other transformers, which would be greater than the iron losses which you sustain temporarily. The object is to design a system to be most efficient at the average load. With a transformer it can be accomplished successfully.

Mr. Robinson, Baltimore: What is the wattless current loss?

Mr. Wagner: The wattless current is inappreciable. The volt-amperes and the watts correspond so nearly in any alternating station at full load that the increase is almost inappreciable, even in the most poorly designed station. The power factor is very high at maximum loads, and with a system of this kind the power factor should be practically 100 per cent. at all times, except for alternating motors, which lower it slightly. The part of the load that comes on the peak is principally incandescent lighting. The motor load is almost constant and the arc-lighting load is much more nearly constant than the incandescent load. The wattless current is small compared with the other current, in any event, and it is found in large alternating-current generators that they can be operated with a considerable increase of current in the armature without materially increasing the temperature of the machine for short periods, as the greatest losses in the generator do not originate in the copper of the armature, and that can be very greatly overloaded without affecting the maximum value of the machine.

Mr. Dow, Detroit: I desire to discuss Mr. Wagner's paper to some extent from the point of information furnished in the paper itself. The points on which Mr. Wagner has based his curves are given. He states the feeder loss in case No. 1 is 24 per cent. That is an exceptionally high feeder loss. It is not radically different from the feeder loss in Mr. Ferguson's paper, 22.8 per cent., but that includes the tie-lines losses over an Edison three-wire station located much farther from the maximum load than his customer. I think that taking the average of Edison stations, and this is assumed to be a representative three-wire direct-current station, the feeder loss is more nearly 12 to 14 per cent. I am familiar with one station where the feeder loss is under 12 per cent. and others where it is 15 per cent. As to the 24 per cent. loss, I cannot think of any station, except possibly the Chicago station, with their tie line included, where the feeder loss would approximate that. A slight modification in the feeder losses will completely change the pressure of the two currents. I think that 24 per cent. loss in general will bring the cost of the feeder itself, particularly the cable feeder, which is now standard, to not much more than the cost of feeder transformers, which Mr. Wagner proposes to employ. The transformer with a cable feeder, capable of carrying 100 kilowatts, can be bought for something like 90 cents a running foot; that is cheap construction, of course, but it is a good figure to compare with the cost of a transformer which is proposed to be used in place of and to avoid the great expense of that feeder. A transformer for 100 kilowatts will cost $1,000 to $1,200, and the initial advantage of the thousand dollars in favor of the direct-current system will pay for a great deal of copper, and the permanency of the one investment as compared with the other is much in favor of the direct current.

Referring again to the figures on the loss in mains, which is assumed to be two per cent. in both cases, I rather take exception to the statement of the condition of load which will prevail in such a station as the representative Edison station, viz., with a large motor load and very respectable arc-lamp load. Mr. Wagner has noted the fact in his paper that the drop in the alternating-current main or feeder is not proportional to the current, where he says: "It would be quite perfect if the drop in alternating-current lines were proportional to the current, but it is not." This will certainly affect the quality of the investment between mains for direct current and alternating current. To get the two per cent. regulation in the mains will certainly, under the conditions of the representative Edison station, involve considerably more investment if the supply is to be by alternating current.

The question of arc lamps as discussed by Mr. Ferguson and the statements made in his paper can be applied directly, in answering Mr. Wagner as to the quality of the two systems in this respect, and I wish to emphasize Mr. Ferguson's statement that the electric elevator, which Mr. Wagner says is just now a difficult and unsettled problem for the alternating-current station, is of primary importance to central-station interests. If you are not able to give good elevator service you will have to submit to the establishment of many isolated plants. It is not a strange condition that if a man has to keep an engineer on his premises to care for a steam boiler and a steam pump for the purpose of running a hydraulic elevator, he will add a dynamo and an engine to supply his own light. On the other hand, if you can furnish him good elevator service, at a reasonable rate, the necessity for the engineer and for the high-pressure steam is eliminated; and in that very point lies the possibility of blocking the establishment of isolated plants. In my case the loss of the elevator service would not be a serious matter as far as the elevator bill is concerned, but the incidental loss of a good deal of valuable lighting would be very serious indeed.

Mr. Wagner has shown what a great many others knew, that the alternating-current service can be wonderfully improved above its customary standard, and that it can be brought up closer to the standard heretofore set by the direct-current stations; but that it is still, unless in most exceptional stations, an inferior service for the conditions which Mr. Wagner has defined as those of the representative Edison three-wire central station. In the case of a densely populated district demanding the

FIG. 1. NIAGARA POWER.—INTERIOR NIAGARA FALLS POWER COMPANY'S STATION.

greater portion of the total supply, the direct current is unquestionably the best; a less densely populated section might be supplied by the alternating system, or it can be supplied, as Mr. Ferguson has suggested, by an alternating system if the distribution is by direct current.

Mr. Wilmerding: Referring to the question of the drop in the feeder on the No. 1 curve in Mr. Wagner's paper, I would ask Mr. Ferguson if his statement that the drop on the trunk line was 12.4 per cent., and to the customer's meter 22.8 per cent., does not include all the losses; that is, all that might be made in the feeders themselves?

Mr. Ferguson: That includes the total volts loss from switchboard to the customer's meter. It is the loss at the time of maximum load, and is not the average loss. The latter is given as 8.8, whereas the maximum loss is 22.8, and that includes the total losses from the station to the customer's meter, the trunk-line losses and the feeder and main losses.

Professor Goldborough, Lafayette, Ind.: In connection with Mr. Wagner's reference to the sub-station transformer, it seems to me that there is an opportunity to improve the low-load efficiency of a plant. I notice from the curve that he has the load falling off and down below the direct-current curve, for that is less than eight per cent. That loss must be due to the inefficiency of the transformer, because the only difference between the two systems is in the transformer, the copper being the same; and the iron loss is the important factor. He said that the iron loss is so small, as his figures indicated, that it is not an appreciable quantity. It seems to me, however, that a system of sub-stations could be devised, a number of transformers placed together, a set of feeders run from the central station to the sub-station, and some of the transformers could be cut out; that there would be a gain there, and a certain number of the feeders would be used in common with a certain number of transformers. In that arrangement you would have less core losses and consequently you would have improved efficiency at the lower load. That improvement I think would be noticeable from about 25 per cent. of the load on down to a very low load, and might be a considerable quantity, for the reason that as the load goes off the power factor of the large transformer comes into play. If you could cut out some of the large transformers and have a few of them fully loaded instead of many of them partially loaded, you will improve the power factor of the whole distributing system, and thereby gain a great deal, because as you reduce the power factor you reduce the volume of current to supply a given amount of current. As to the means of cutting out and cutting in these transformers, that would be a matter of considerable expense and you would have to employ a man for that special purpose. Such a system can be devised. It might be a system of relays by means of a small wire. You could send out a line from the central station to the sub-station and operate it by a relay electro-magnetic device which would throw in or throw out the switches for the transformers on the transformer primary. This system is in operation in England to some extent, as well as on the continent, although I do not believe it has been particularly successful as yet. I see no reason why the low-load efficiency of an alternating-current station cannot be considerably improved.

As to the matter of the arc lights, I was pleased to hear that they are making such progress in St. Louis. I remember that some years ago the Westinghouse company made an extended experiment to reduce the humming of the arc lamp. I imagine that would still be a detriment to the old form of open series arc lamp. As to the efficiency of the inclosed arc lamp we made experiments to determine the efficiency of alternating current in enclosed arc lights, and we found that the efficiency would vary greatly. The efficiency of the lamp, as a whole, is much less than with direct current, and it takes more power. If they could use an open reflector above the arc lamp, it would introduce a marked saving and make the comparison between the alternating-current and direct-current lamps more favorable to the former.

I was also much pleased to hear Mr. Wagner express himself so strongly in favor of the single-phase alternating current. The single-phase alternating current possesses the same features of simplicity that are possessed by the direct current. I believe ultimately we will get a good single-phase alternating-current motor. The single-phase alternating-current system has many advantages over the multiphase system, especially in regulation.

It has been said that the alternating arc lamp has found a rival in the Welsbach burner; that we do not supply the arc light as cheaply as the mantle. I think that is not altogether so, for the reason that the gas light is becoming unpopular in the East. It is not at all suitable for interior lighting and won't do at all for entertainments, as it makes everything ghastly, whereas the arc lamp gives a steady light. A strenuous effort has been made in one of the cities of Indiana to supplant the alternating-current arc light by gas light. Matters went so far that the gas company put in the mantles free of charge and the people had a fair chance to test them. In a great many cases they have been taken out again as unsatisfactory, and in their place arc lights are being used.

Mr. Scovil, Cleveland: Mr. Wagner's paper contains this statement: "I might say that where lighting is a distinct feature, and first-class service is to be rendered from a large station, the three-phase system cannot be used successfully." If there is any technical man who takes an opposite view on that question, I hope he will give us the benefit of his experience and judgment.

Mr. Rice, Brooklyn: I have visited the stations at Salt Lake City and Sacramento, and spent several days with the designing engineers of both cities, and they both claim superior efficiency and elasticity to the Edison three-wire system. They have the three-phase four-wire distribution system in the Salt Lake plant, considerably over 10 miles—I think about 15—and at Sacramento it is nearly 20 miles.

It seems to me in this discussion that we are comparing two systems, one of which is brought to a high state of development, and one of which is just beginning to be developed. I think Mr. Ferguson's example of the alternating plant is very unfortunate, in that it does not represent an alternating plant of the latest design. It is now past discussion that alternators may be thrown in parallel, the same as continuous-current generators. The use of motors is another feature which is coming into prominence. The alternating-current motors have not been developed and applied the same as continuous-current motors, simply because they have not lived long enough. In time I expect to see alternating-current motors distributed as widely and as universally as continuous-current motors. The same idea applies to the arc lamp. We have had arc lamps for a great many years on the continuous-current system, but only recently have they been developed and made acceptable on the alternating-current system.

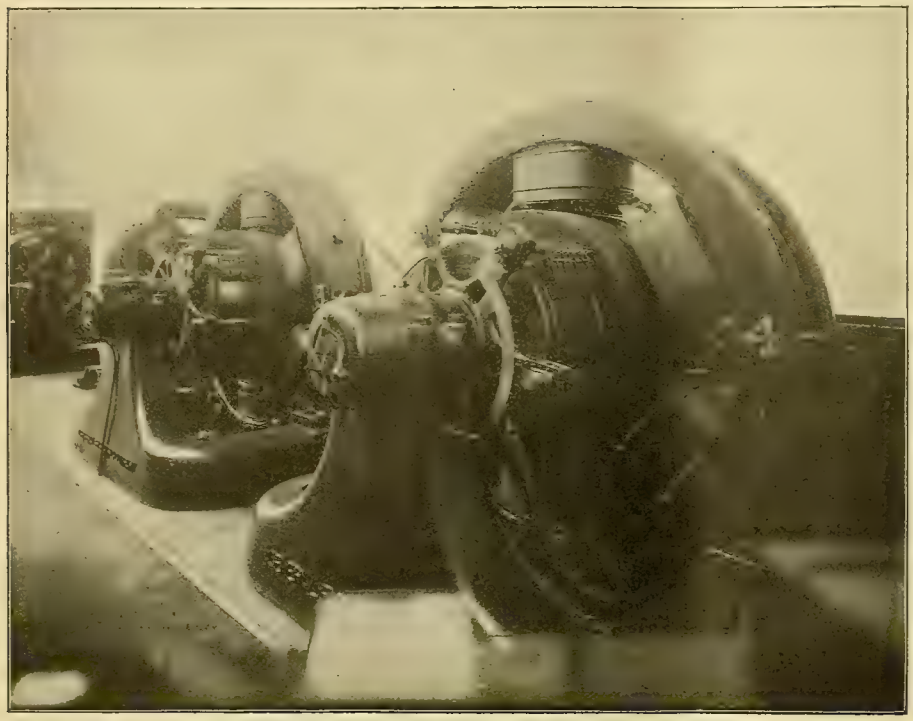


FIG. 3. NIAGARA POWER.—NEW ROTARIES IN BUFFALO RAILWAY PLANT.

Chicago and Milwaukee Electric Railway.

The opening of a portion of the Chicago and Milwaukee electric railway for traffic on July 1st attracted considerable interest among railroad men, particularly those interested in long lines for suburban and interurban traffic, as there were several points in the design and construction of the plant which were radical departures from ordinary electric-railway practice. The name of the road would indicate that the line would connect Milwaukee with Chicago, and it may be the purpose of the promoters to do so ultimately, but thus far their plans do not include an extension beyond Waukegan. This line is not yet completed and it is now being operated by means of a temporary electrical equipment in the power house, as the generating apparatus designed for the installation is not yet ready for service.

The line runs through a chain of beautiful suburban districts lying along the shore of Lake Michigan, beginning with Evanston and ending with Waukegan. The southern portion of the road will unite Evanston, North Evanston, Wilmette, Kenilworth, Winnetka, Lakeside, Glencoe, Ravinia and Highland Park. From Highland Park north to Waukegan the line is now completed and in operation. The government reservation at Fort Sheridan, the university at Lake Forest, the camping grounds at Lake Bluff and the manufacturing districts at North Chicago and Waukegan lend interest to this portion of the road. The line is 30 miles in length and parallels for the entire distance the Chicago and Northwestern steam railroad.

In building this line the engineer was confronted with the same problems that are usually connected with the installation and operation of a high-speed, long-distance suburban electric road. The burdensome investment in copper feeders which would have been necessary to operate the road from a direct-current station situated at the center of the line made such a plan impracticable, and the inefficiency in the operation of two power stations for a road of this size or of a booster system operated from one power house was recognized. The engineer was confronted with the problem of designing a system of generation and distribution which would represent a minimum amount of first investment, permitting additions as the load increased in a manner consistent with the original installation, operating with a fair degree of economy from the start, and, at the same time, being capable of the highest operative efficiency when eventually completed.

The plan adopted consisted of a combination direct-current and three-phase alternating-current distribution system with a generating station placed at the center of the line. The sections of the road adjacent to the power station are supplied with direct current from the power house itself, and beyond these sections power is supplied from sub-stations. Each of these sub-stations contains a rotary converter, consisting of a three-phase alternating-current motor and a direct-current generator combined in one machine. The sub-station motors are supplied with power over a high-tension transmission line consisting of three small copper wires extending back to the power house. The direct current from each sub-station is distributed to the trolley by means of the usual system of feeders extending in both directions. The location of these sub-stations and their distance apart is governed by the conditions of traffic and somewhat by the nature of the grades along the line.

As shown upon the accompanying map, the power station is located at Highwood and the sub-station for the operation of the northern portion of the road near the southern limits of North Chicago. Connecting the power house with the sub-station is an eight-mile, 5,500-volt, three phase transmission line of three No. 8 wires. From the sub-station the co trolley wire is reinforced by a 0000 feeder extending four miles south and a 000 feeder extending 3½ miles north. The subway near the sub-station, by means of which the electric cars pass under the Northwestern tracks, is an interesting piece of engineering not yet completed.

In the construction of the track 65 pound T rails and 75 pound girder Johnson rails are used. The overhead work is of the side-pole method of construction in the outlying districts, with center iron poles through the business district of each suburb. The high-voltage tie line wires are supported on glass insulators carried on wooden crossarms on the side poles. Each pole is painted, while those carrying the alternating-current lines have a danger notice stenciled upon them.

The line as at present operated is a single-track road, except in Lake Forest, and a block signal system has been adopted to insure safety in operation. The present equipment comprises 14 cars, 10 of which are 32-foot cars made by the St. Louis Car company. The Pullman company is now completing two interurban railway passenger coaches and

two combination passenger and baggage coaches, each 38 feet long, with two 50 horse power motor equipments, mounted on Peckham double standard railway trucks.

The boilers are of the water-tube type, made by Aultman & Taylor, each having a rated capacity of 250 horse power. They are set in batteries of two each in such a manner as to be entirely independent of the brickwork. The boilers are thus free to contract or expand, and the brickwork may be entirely removed and replaced if required without disturbing the boilers or connections.

A steel stack of sufficient capacity to handle the escaping gases from eight boilers is to be placed so as to be flanked on either side by four boilers. Three of these boilers are now installed. Fuel economizers will be placed at the back of each battery of boilers, with the by-pass flue beneath. Sterator slack coal is used and is delivered in front of the boilers directly from the cars. The furnaces are of the Hawley down-draft type. The supply of feed-water is taken at present from the city mains, and is furnished to the boilers by means of the Q and C system of boiler feeding.

The engines of the plant are of the horizontal tandem-compound Corliss type, and run at 125 revolutions per minute. The dimensions of the one at present installed is 17 inches by 30 inches by 36 inches. This engine was made by the Filer & Stowell company of Milwaukee, and is rated at 400-horse power. The fly wheel weighs 40,000 pounds, and is 14 feet in diameter. The governor of the engine is of the Provell inverted type, fitted with automatic safety stops to prevent the engine running away. This stop blocks the governor balls up except in the event of the governor belt breaking. The device is arranged so as not to need handling at the starting or stopping of the engine.

The present engine is of the side-crank type. Future additions of engine units will be of the center-crank type, and will also be of double the rated power of the original unit. Each engine is also designed to stand an overload of 100 per cent. This provision is made for emergency service, when the engine can be made to develop a power greatly in excess of its rating by admitting high-pressure steam into the receiver through a reducing valve.

The unique feature of the power station, however, is the electrical equipment. Two different types of machines are employed. Generator No. 1, which is installed next to the engine No. 1, is an alternating three-phase generator of General Electric make. It has a capacity of 250 kilowatts at 125 revolutions per minute. This generator has 24 poles, and, therefore, delivers a three-phase current of 25 cycles per second. This current is generated at a potential of 5,500 volts, ready to be delivered directly to the transmission lines without the use of transformers. Generator No. 2 is a combination generator. It is also of 250 kilowatts capacity, and runs at 125 revolutions per minute. It can deliver its output, however, either as direct or as three-phase current. It has but one armature, but the windings of this armature are connected on one side to a commutator and on the other side to collector rings. The potential of the direct-current end is 600 volts, while the three-phase current is delivered at a voltage of 380. The generator can deliver an output up to its rated capacity of 250 kilowatts from either the commutator or collector rings. It can thus be used to supply current directly to the trolley passing in front of the power station, or can be used to operate the motors in the sub-stations, or for both purposes at the same time, dividing the load in proportion to the demand. It will be noticed that generator No. 2 is of considerably lower voltage than generator No. 1. When the three-phase current from this generator is transmitted to the sub-station it is necessary to raise its potential from 380 volts to 5,500 volts. This is accomplished by means of static transformers placed in the basement. These transformers are cooled by a blast fan operated by a one horse power iduction motor. Generator No. 3 is to be a duplicate of generator No. 1.

The engines and generators are connected by means of the Arnold system. This system has been described in detail in the Western Electrician. It is said to be particularly adapted to a station of this character, containing, as it does, two different types of generators. When the load is light the road may be operated from the alternating-current direct-connected generator, and this is always available from two engines. In case of a breakdown of one engine this generator may be connected to the other engine.

As the demand for the current varies, the load may be transferred from one engine to another, or all engines may be operated in unison, which is important when working alternating generators in parallel. As each generator is mounted on independent bearings, it is possible, if occasion should arise, to operate generator No. 2 as a rotary converter, or even to connect generators Nos. 1 and 2 so that they could be used in the same manner.

The sub-stations are to contain the static step-down transformers, the rotary converter and a storage battery. It will be noticed that the electrical equipment of the sub-stations is not in duplicate. This has been considered unnecessary, as it is intended to mount the machinery needed for a sub-station, static step-down transformers and one rotary converter, upon a truck fitted with motors. In case of breakdown at any sub-station the battery can be relied on to supply current for several hours, during which time the portable reserve sub-station equipment can propel itself to the crippled station and be connected ready to operate until the repairs have been made.

The storage battery in a sub-station of this character has many advantages. It supplies all the sudden and excessive demands for current, due to the fluctuating load peculiar to a road of this kind, containing many curves and grades and operating few and heavy trains. The rotary converter can be made to carry a fairly average load, and in turn the generating machinery at the power house can be operated under constant conditions. This feature of steady load cannot fail to contribute to the fuel economy of the generating station. As the station is relieved of the necessity of supplying the occasional maximum load by the ability of the sub-station batteries to respond for short periods to an excessive demand, machinery of much less capacity is required in the power house than if the batteries were not used. A correspondingly reduced investment is required in transmission lines and rotary converters. To these advantages may be added one more, which is peculiar to the alternating-direct-current system of distribution. The effect of the self-induction of the alternating-current motors in the sub-stations compel considerations of "leading" and "lagging" currents, which may become extremely troublesome. The best condition for operation is when the power factor of the circuit is unity; that is, when the apparent energy is equal to the real energy. The strength of the motor field can be adjusted at any given load so as to neutralize the inductance of the line, and leave the current nearly in phase with the electromotive force. If the motor can operate at or near this given load, the power factor will not depart far from unity, and the circuit will act like a continuous-current line. If the load vary, however, to any great extent, the resulting "false current" may compel the transmission over the lines of a current greater than that really required to operate the motor. The storage battery, by furnishing a reservoir to which energy may be given or from which energy may be taken as the load varies, enables the rotary converter to carry a practically steady load, and thus the accumulator contributes much toward maintaining an electrical balance in the alternating-current circuits. As the road is extended and the traffic becomes heavier, the conditions of the service will probably make the installation of a battery at the main power house a desirable investment.

The road was planned and the power house designed by Bion J. Arnold of Chicago, the consulting engineer of the company. The original projectors of this line were C. E. Loss & Co. of Chicago, who were also the contractors and builders. The Chicago and Milwaukee Electric Railway company was organized to purchase and operate this property. The officers are G. A. Ball, president, A. C. Frost, vice-president and treasurer, George M. Seward, secretary and auditor, and R. S. Ives, general superintendent.

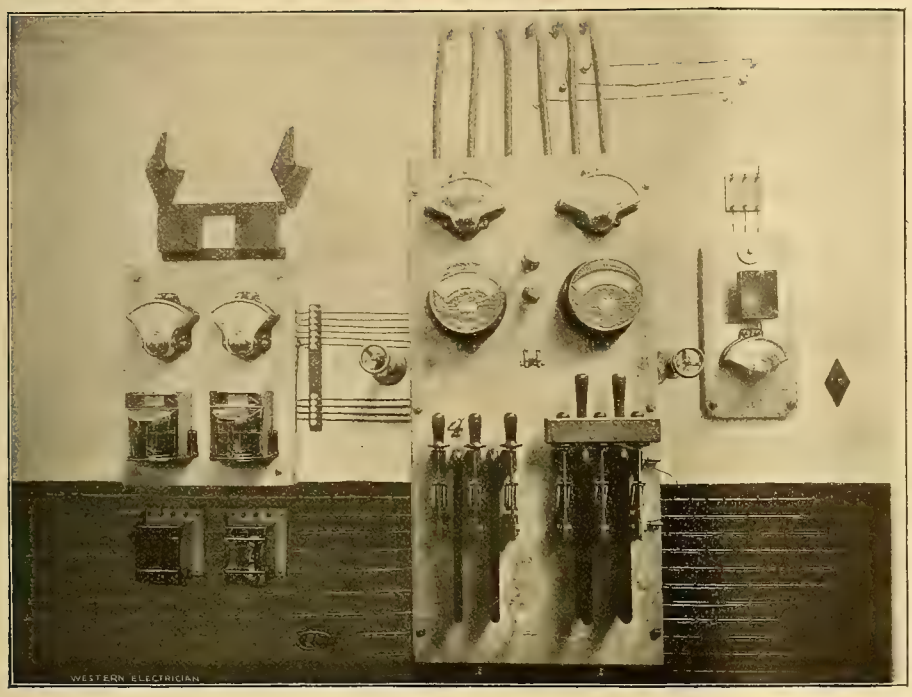
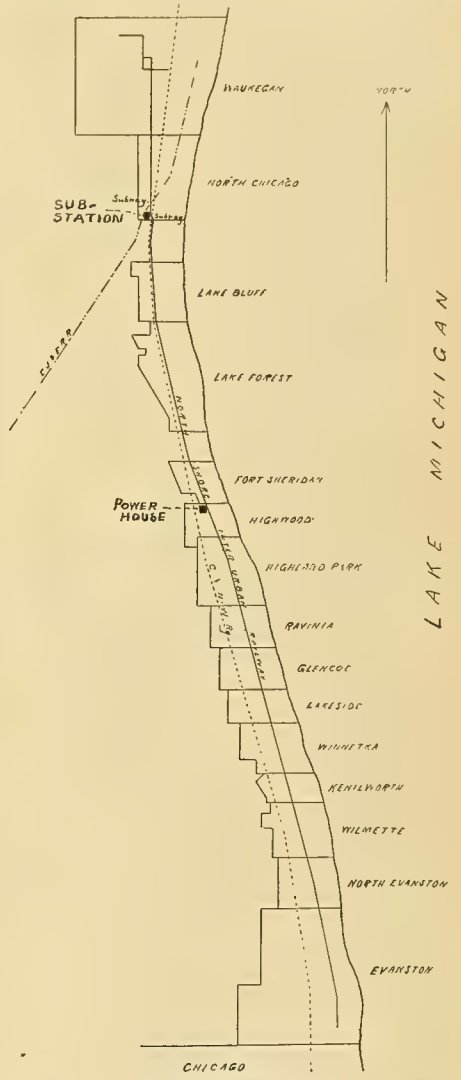


FIG. 4 NIAGARA POWER—BUFFALO RAILWAY COMPANY'S SWITCHBOARD FOR NEW ROTARIES.



CHICAGO AND MILWAUKEE ELECTRIC RAILWAY.—MAP SHOWING ROUTE.

Canadian Mica Supply.

In a paper read before the Federated Canadian Mining Institute it was stated that several prospects for mica were made in the Gatineau district, but they were of small importance. In the vicinity of Perkins Mill, in Templeton, three important companies have worked regularly and taken out a large quantity of mica, well adapted for electrical purposes, of which a good part has been sold in the United States. It is difficult to give exact figures regarding this mineral, on account of the numerous qualities and sizes, representing as many different prices, but according to the best information it is estimated that about 200 short tons of thumb-trimmed mica have been taken out, 90 men being employed. The demand has diminished, on account of the high duty in the United States, and only the best grade of electrical mica is wanted.

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Calamity howlers have been making trouble for the surface and elevated railway companies whose cars cross Brooklyn bridge, but it seems, according to the bridge commissioners' report on the subject, that there is no reason to fear that the structure has been weakened. It was claimed that the great weight of the trolley cars when crowded on the bridge during a temporary blockade, or when run too close together in the rush hours, had injured the great span by causing one of the stays to sag. The engineers say, however, in an official report that "this is not new, and has occurred several times before." It has been determined, however, to enforce a rule requiring cars on the bridge to be run not closer than 102 feet. This may seriously interfere with the efficiency of the transportation service.

The reorganization of the Signal Corps of the United States Army is suggested, and it is quite probable that the matter will receive early attention. At present the corps consists of about 110 officers and 1,200 enlisted men. In addition to their duties in connection with the Signal Service proper, such as the establishment and maintenance of communication with the several armies in the field by telegraph, telephone, balloon, heliograph and banners, all the labor of installing electric plants has developed upon them. The work of this branch of the service has been highly efficient, but it is not to be expected that the government can command the services of men of experience in electrical work, now that peace has been declared, unless some provision is made for recognition of their services and suitable compensation is offered. It is therefore proposed to reorganize the corps as a special branch of the regular army on the basis of 25 officers and 500 enlisted men, who will be trained for this work.

The limitations of the authority of municipalities to engage in competition with private commercial interests have not been clearly defined in this country, although the courts have determined in special cases that there are restrictions which must be observed. It will be interesting, therefore, to note the views of the English courts upon the same subject. Municipal trading in electric-lighting fixtures has been declared to be beyond the powers of municipal corporations in England in the absence of legislative authority to that effect. The London Surveyor mentions a case growing out of a transaction in Leicester, where the town brought action to recover $25 from a tradesman to whom it had sold lamps and other fittings. The court decided that since the goods had been furnished they must be paid for, but ruled that the plaintiff should bear the costs, and declared that it had clearly exceeded its powers. It was shown that the town did not restrict its trade to patrons of its lighting plant, which might have altered the case, especially the supplying of lamps and fittings.

Mr. Eastwood's communication upon the failure of the water supply of the San Joaquin Electric company, which is printed elsewhere, confirms the views expressed by this journal upon the necessity of engineers making careful and thorough examinations of the records of the section of the country upon which dependence is to be placed for water, and then providing against possible contingencies. Mr. Eastwood says that "the condition that prevails in the present season occurs in California about once in 30 years, the present season being the shortest in precipitation since 1864." In spite of this knowledge, the company was found unprepared. It was certainly unfortunate that a shortage should have occurred at this time, but the fact that other companies are experiencing the same trouble does not help those depending upon San Joaquin for power. It would seem as if the importance of this subject might have impressed upon the engineers the necessity of making provision for storage capacity one of the first matters to engage their attention. In many similar cases the failure of the plant is attributed to some defect in the electrical equipment, but fortunately in the present case there is no chance for confusion, as it has been apparent from the start that the entire trouble is due to the failure of the company to make ample provision for water storage.

According to the San Francisco Chronicle the city of Sacramento has also been suffering from lack of power, due to shortage of water. Electric current for the cars and lights of the city is generated on the American River at Folsom, but the water became so low that the Folsom power house had to shut down. The Sacramento Electric, Gas and Railway company, which owns the plant, at once took steps to run the plant with steam power generated in Sacramento. Power is furnished manufacturers from the Folsom plant, and the shortage has consequently affected these industries quite seriously. It is feared that this condition will prevail until the winter rains relieve the situation. It is explained on behalf of the company that while the principal trouble has arisen because of the remarkably low water in the American River, the company lays part of the blame for its difficulties on the owners of the North Fork irrigating ditch, near Orange Valley, claiming that they are diverting more water from the electric company's canal than they are entitled to. The question will be determined by the courts.

According to published interviews with President Vreeland of the Metropolitan Street Railway company of New York, it has been decided to substitute electricity for the cable as the motive power on Broadway. The company has obtained permission to make the change, and securities will be issued to raise the needed funds for the work, which will be undertaken just as soon as the underground trolley system on Eighth and Sixth avenues is completed.

The determination of the Metropolitan company to discard the cable system and introduce the conduit trolley in its place is an important victory for the electric system. The conditions were particularly favorable in New York for the introduction of the underground trolley, as it will enable the company to operate cars from other lines on Broadway, and this will greatly improve the service. During the rush hours, particularly, it is pointed out, there will be considerable advantage in having all the cars leading to the downtown district operated by the same motive power, as they can turn into Broadway and carry their patrons to their destination without necessitating a change of cars. The superiority of the electric system over the cable warranted the directors in discarding the costly equipment now employed, although the apparatus is practically new and cannot be advantageously disposed of, as there is no longer any demand for this class of equipment. It is stated on good authority that the experience of the Metropolitan company indicates that when the electric system is completed the cost of operation will be greatly reduced. It is also said that the company was disappointed in the cable system, as it proved far more costly than had been anticipated.

The rights of quasi-public corporations and municipalities and their respective obligations form the subject of a thoughtful expression by the Supreme Court of Kansas in reviewing an attempted rescission of a city contract for electric lighting. The case involves many points of common interest to electric-lighting companies enjoying city contracts, and the views of the court will be read with considerable interest.

It appears that the city of Osawatomie granted a franchise and entered into a contract with an electric-lighting concern "to construct, reconstruct, maintain, repair and operate" an electric-light plant for furnishing light to the city for a period of eight years at a stipulated rate, the city to make monthly payments for the light furnished. The right to rescind the contract for non-performance was not reserved to the city in the contract itself. The plant was built and operated for a long time under the contract, and then, without the fault of the owner, it was partially destroyed by fire. The owner determined to rebuild the plant, and proceeded to do so without unjustifiable delay. The city, although well aware of this fact, gave no notice of a purpose to terminate the contract until the plant was practically rebuilt.

Under the circumstances, the court holds that the city was not entitled to renounce the entire contract, though it had a right to recover such damages as were sustained by reason of non-performance. It holds that the lighting company is entitled to protection, because on the faith of the contract for city lighting a large expenditure was made for complicated machinery, which was liable to be injured or broken by use. The municipality realized that there might be interruptions of the plant and that repairs might become necessary, as the ordinance provided for the repair and reconstruction of the appliances and machinery. Furthermore, it is common knowledge that there are frequent interruptions in the running of such machinery, and it will hardly be contended, continues the court, that an interruption of a day or two would work a forfeiture of the franchise and of the rights of the owner of the plant under the contract. If there was an unreasonable, and the right to rescind, if it existed, tifiable failure to perform the service required by the terms of the agreement, a rescission of the contract might be had, but the delay in rebuilding was reasonable and the right to rescind, if it existed, was not exercised by the city within a reasonable time. It is generally accepted that if a party to a contract has a right to rescind it, he must exercise the right within a reasonable time, and not wait until a rescission will work a great injury to the opposite party. Unreasonable delay on the part of him to whom the right to rescind belongs is generally deemed to be a waiver thereof.

Moreover, the court considers that the city could not relieve itself from the obligations of the contract by passing an ordinance which attempted to repeal the franchise ordinance.

WAR NEWS.

The End of the War.—A protocol or preliminary treaty of peace between the representatives of the United States and Spain was signed in Washington on August 12th. Hostilities have been suspended, and the war is regarded as ended, after a duration of three months and 22 days. This will, therefore, be the last issue of the Western Electrician with a specific department of "War News," although it is hoped that the readers of this journal will have the benefit of the valuable lessons of the conflict, particularly in their electrical application, in later numbers, as they are available from official reports and other sources. The Western Electrician's department of "War News" dates back to the issue of April 9th, over two weeks before the beginning of hostilities, and appears in 20 issues of the paper.

Cable Communication with Manila.—Owing to the lack of cable communication betwen Hongkong and Manila, the news of the suspension of hostilities between the American and Spanish forces did not reach Admiral Dewey and General Merritt in time to prevent their attack upon Manila. The protocol was signed on Friday, August 12th, and word was sent to all the commanders at once, but the messages from Washington were detained at Hongkong until Saturday and then carried by boat to Manila. In the meantime Manila had fallen into the hands of the Americans, the Spanish governor-general having fled on a German war vessel to Hongkong, only to learn that had he remained at his post a few hours longer he would have been the Spanish hero of the war. The delay in delivering this important message was due to the fact that the cable between Manila and Hongkong, which was cut by Admiral Dewey after the destruction of the Spanish squadron, had not been repaired. The message traveled 13,653 miles over land lines and submarine cables betwen Washington and Hongkong and was then taken 628 miles on the dispatch boat to its destination.

CABLE COMMUNICATION WITH MANILA.—ROUTE TRAVERSED BY MESSAGE FROM WASHINGTON TO PHILIPPINES ANNOUNCING PEACE; BROKEN LINE INDICATES CABLE CUT BETWEEN HONGKONG AND MANILA.

Mr. E. J. Nally, the assistant general superintendent of the Postal Telegraph-cable company, prepared the accompanying map showing the route between Washington and Manila over the Postal Telegraph-cable company's lines to New York, the Commercial Cable company's submarine cable to Lands End, the Eastern Telegraph company's system to Bombay, the land lines of the Indian government to Madras, the starting point of the Eastern Extension, Australasia and China Telegraph company's system, which completes the connection to Hongkong. The last-named company controls the line to Manila, shown by broken lines on the map, which was cut by Admiral Dewey. The principal points on the line where the message would be transferred or repeated and the intervening distances are as follows:

	Miles.
Washington to New York	251
New York to Canso	840
Canso to Lands End	2,100
Lands End to Lisbon	856
Lisbon to Gibraltar	337
Gibraltar to Malta	1,126
Malta to Alexandria	913
Alexandria to Suez	200
Suez to Aden	1,403
Aden to Bombay	1,851
Bombay to Madras	800
Madras to Penang	1,498
Penang to Singapore	388
Singapore to Saigon	630
Saigon to Hongkong	460

The action of the Spanish governor-general of the Philippines in flying from Manila greatly simplifies the problem, so far as the cable question is concerned. One of the first actions of Admiral Dewey will be to repair the broken cable and open communication between Manila and Hongkong. The operators and repair gangs of the cable company have remained at Manila throughout the war, although they were unable to work the line. An immediate re-establishment of communication will be desired, of course, by the government, and it is expected that everything possible will be done to restore peace and prosperity in the islands.

Volunteer Engineers.—After several delays, the transport Chester, with the First Regiment of Volunteer Engineers on board, sailed from New York harbor early on the morning of August 10th for Porto Rico. The regiment numbers, all told, 1,154 men, and had been on board the steamer since August 5th. The men were placed on the transport before she had been fully provisioned and fitted out for the trip, and as a result they were held on the boat longer than expected. All of them took the detention good-naturedly and made the best of the situation. They were decidedly happy when they got under way for Porto Rico. Colonel Eugene Griffin, of the General Electric company, is in command of the regiment and sailed with it. The ship is crowded, and the men suffered from the heat while the vessel was at anchor in the harbor. Electric fans were placed in the hold to assist in ventilating the ship. It was said that on account of the crowded condition of the Chester orders had been issued that when she was well out to sea 25 men out of very company should spend two hours on deck and four hours below, in order that there might be as little discomfort as possible. Hostilities were suspended two days after the vessel sailed, so that the regiment's duties in Porto Rico, if it is not turned back before reaching that island, will not be very warlike.

The Engineers' Club of New York offered the First Regiment of Volunteer Engineers a stand of colors, and the offer was accepted. A committee of the club was also appointed to solicit from engineers and engineering societies contributions to a fund to purchase appliances for the brigade of volunteer engineers for which no government appropriation was available. It was especially desired, under the sanction of Colonel Griffin, to provide portable electrical searchlight equipments. One such apparatus can be procured, complete, in single self-contained units, for about $3,000. "The employment of a searchlight in the army would be a novelty," says the committee, "but its success would be assured in the hands of engineer officers. Its field of application is wider than that of the navy; as, say, in bridge and track construction or destruction, earth work, road making, repairing, searching the field for wounded, for use at hospitals in surgical operations, at headquarters for draughting, and the like." With the advent of peace it is to be presumed that this scheme will be abandoned.

The Second Regiment of Volunteer Engineers, which had made headquarters at Fort Sheridan, Ill., received marching orders on August 11th. It was destined for Montauk Point, Long Island, according to the newspapers.

Repair Ship Vulcan.—Further news from the Vulcan, the floating machine shop which attended to the mechanical wants of the American fleet in Cuban waters, testifies to the value of the equipment. The ship has a complete equipment, not only for repairs of a lighter nature, but to do much heavy work which had not been attempted hitherto on shipboard. In her machinist department she has nine lathes, some of large dimensions in swing and center distance, besides a large outfit of planers, shapers, drill presses, bolt-cutting and pipe-threading machines, tool-grinders, grindstones, etc. The molders' department includes one 36-inch cupola, of the most improved design, to melt 3,000 pounds of metal at each tapping, with a blowing engine to furnish blast; one furnace, ironed, with fire brick, to take three 100-pound crucibles, and the necessary equipment of crucibles and molders' tools. The blacksmiths' department is equipped with five forges, the largest of which is an open-hearth forge five feet in diameter, built of brick and iron, fitted with power blast, and used for heavy forging and flange turning. Two of the other forges also have power blasts. This department's plant comprises also blowing machinery, power and hand; anvils, and a number of complete sets of forge tools.

In the boilermakers' department there are 50 boilermakers' kits, with all necessary tools for handwork; a power punch and shears, a set of hand rolls six inches in diameter by six feet long; rivet-heating forges, tube cutters, screw punches, etc. The coppersmiths' department is also very complete, including, besides tinsmiths' furnaces and light tools, a brazing forge with two circular and one long fire for blast to be built up in light iron and lined with firebrick. There are included also, in the general equipment of the ship, shafting, pulleys, belting, etc., for driving the large plant of tools which has been installed; a vertical, double-cylinder steam engine of 50 horse power to furnish the motive force for the plant, four 6,000-gallon evaporators and four distilling apparatus for fresh water, with also feed and circulating pumps, blowers, etc.

The character of the work done by the repair ship is shown to some extent in a letter from one of her officers, who, writing from Guantanamo Bay, says: "In regard to this vessel and its utility, I can only say that we are busy night and day. Our brass furnace is going every day, there having been unexpected calls for brass castings of all kinds and sizes. It seemed that every vessel in the fleet—colliers, transports, supply and war ships—has either a winch, a blower engine or a dynamo broken down. New eccentric straps and rods galore are required, with new brasses, gun castings, etc. We have supplied also an enormous quantity of stores to the different ships. As I said before, we are busy all the time, and there is no vessel in the fleet but has had something done for it. The torpedo boats, small yachts and tugs have required the most work."

The Havana Cable.—A few hours after the peace protocol was signed in Washington, news was received of fighting at Manzanillo. President McKinley gave General Greely, the chief signal officer of the army, full authority to do the best that could be done to get the news of the peace agreement to Manzanillo. Prior to his visit to the white house, it seems, General Greely had sent a personal unofficial message to Captain-General Blanco, informing him of the signing of the protocol and the suspension of hostilities. After leaving the president General Greely saw the acting secretary of the Navy Department and had him prepare a message in cipher to the senior American naval officer off Manzanillo. This message General Greely sent to Havana, preceding it with a message in plain English to the senior naval officer, saying that hostilities had been suspended and that a message of in-

[*Continued on page 108.*]

DEVELOPMENT OF THE TELEPHONE FIELD.

Evolution of the Line Signal.

By Arthur Vaughn Abbott.

Part II.

Many forms of luminous signals have been suggested, but the only one in successful operation at present is the miniature incandescent lamp, which has, on the whole, proven itself of the greatest value. So far as the writer can ascertain, the idea of employing incandescent lamps for signal purposes arose with Mr. J. J. O'Connell of the Chicago Telephone company, who suggested in 1888 the employment of an incandescent lamp upon burglar-alarm circuits in order to permit the legitimate occupant of a protected room to send to the alarm office an identification signal whereby his entrance to the premises could be made known.

In the latter part of the summer of 1890 some of the trunk lines in use in Chicago were provided with disconnect signals using miniature incandescent lamps. At the receiving office the trunk lines terminated in the ordinary cords and plugs used upon a telephone switchboard, in front of each of which an incandescent lamp was located. So long as the line was in use a relay in conjunction therewith was excited by battery current flowing over the line, and its armature drawn up. As soon as conversation was completed the operator at the originating office withdrew the plug from the trunk-line jack at that office, thus opening the battery circuit and causing the relay to be de-energized. The release of the relay armature completed a local battery circuit, illuminating the incandescent lamp. The operator at the receiving office, noticing the illumination of the lamp, was thereby informed that conversation was completed and instructed to remove the trunk-line plug. As the local lamp circuit was carried through the operator's listening key, the placing of this key in the testing position extinguished the lamp. A very short experience served to demonstrate the superiority of incandescent lamps over any other form of signal, for the illuminated lamp was at once so positive and distinct as to instantly attract the attention of the operator, thus markedly accelerating switchboard work. As a result of this experience, most of the trunk lines in the main office of the Chicago Telephone company were rapidly supplied with lamp signals.

In the spring of 1893 it was proposed to re-equip a large multiple board in the Chicago exchange with self-restoring drops, but the expense and difficulty of this change caused the management to hesitate, and at this time the writer suggested the employment of incandescent lamps as subscribers' line signals, on the ground of greater economy in space and in installation, as well as improved signal efficiency. More conservative telephonists doubted the wisdom of such a recommendation, fearing that the numerous relay contacts would be a perpetual source of trouble, and no further steps were taken with this project. In the winter of 1894 a new type of switchboard known as the "express board" was introduced. As this board was designed to meet the wants of metallic-circuit subscribers, particularly those whose telephonic business was large, it was decided to provide incandescent-lamp line signals. The circuit of this board was so arranged that on the removal of the subscriber's receiver from its suspending hook, the movement of the hook closed the circuit and allowed battery current to flow through the line. This current actuated a relay at the exchange, in the local of which the signal was placed, situated behind a ground glass shade upon which the number of the subscriber was painted. The illumination of this disk displayed a very distinct and conspicuous signal that immediately attracted the operator's attention. Notwithstanding some apprehension as to the possibility of trouble with relay contacts, the service given by the lamp signal was, on the whole, so satisfactory as immediately to concentrate telephonic attention upon the use of lamps, and within the four years that have since elapsed the superiority of the incandescent lamp for this purpose has been so fully demonstrated that nearly all of the large switchboards which are at present being constructed are completely supplied with signals of this description.

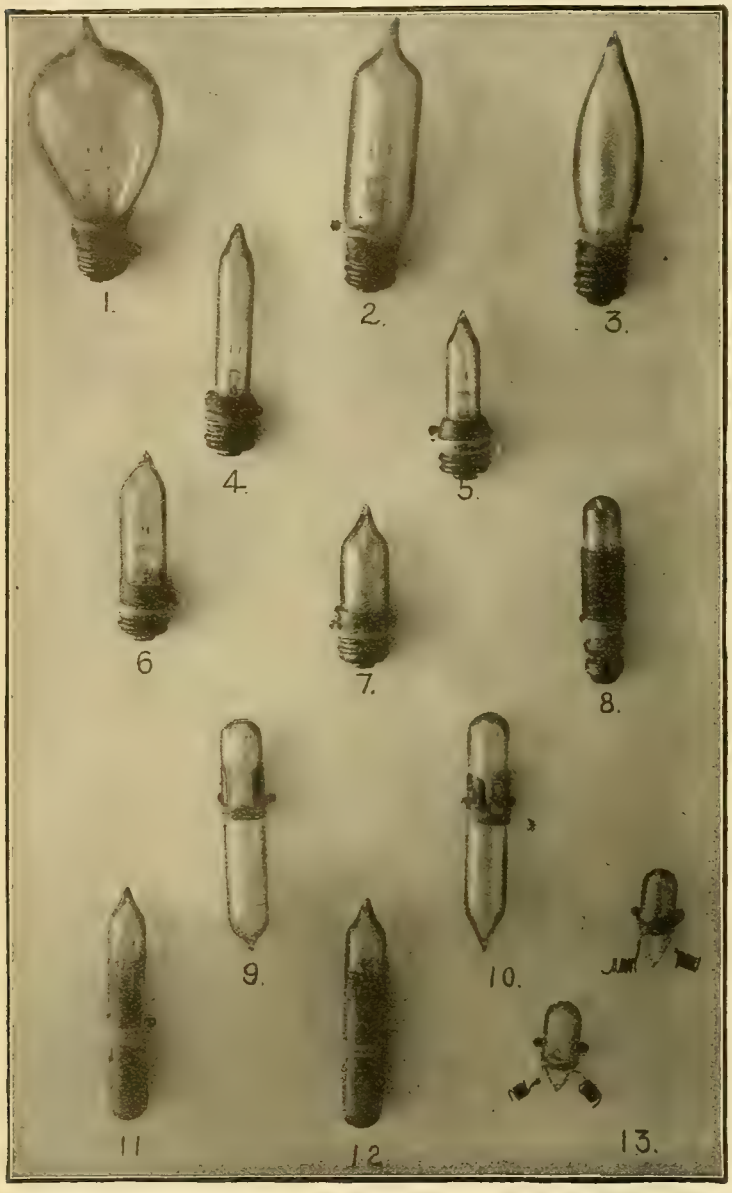


FIG. 7. EVOLUTION OF THE LINE SIGNAL.

As the service to which the incandescent lamp when used as a signal is subjected is peculiar, the employment of lamps upon telephone switchboards has afforded lamp manufacturers a new problem. In the early experiments ordinary miniature lamps of low voltage were employed. As these lamps were bulky and consumed a large amount of current, the first attempts at improvement were directed to obtaining a smaller and more economical lamp. The various changes through which the lamp has passed are illustrated in Fig. 7, in which No. 1 is the original type of lamp employed; Nos. 11 and 12 are those which experience has now demonstrated to be the most successful. Lamp No. 1 had a bulb about one inch in diameter and was about two inches long. Electrically it was designed for a four-volt circuit requiring over one-half ampere, and giving about two candle power. Lamps Nos. 11 and 12 are 1¾ inches long with a bulb one-fourth inch in diameter. They are designed for a 24-volt circuit, consume about 0.1 ampere and yield over one-fourth candle power. The early lamps were designed entirely to fit a socket supplied with a screw thread, as exemplified in Fig. 8.

The socket consisted of a brass tube, in the bottom of which a screw base was placed matching the thread upon the lamp. A cap carrying a ground glass shade covered the front end of the tube, while from the rear two conductors extended, one fastened to the thread of the socket, thus connecting with one of the lamp leading-in wires, while the other was arranged to make contact with the other leading-in wire in the center of the lamp base. This conductor was supplied with a spiral spring, the pressure of which it was expected would lock the lamp in its place and constantly maintain good electrical contact. This expectation was not fulfilled, for one of the greatest troubles encountered has been the loosening of the lamp in its socket, due to the almost inappreciable jarring to which all buildings are subjected. Lamps in sockets of this description will gradually unscrew, opening the electrical circuit; they are then incapacitated as signals and considerable complaint will arise. Lamp sockets of this kind were designed for lamps Nos. 4 to 7, inclusive (Fig. 7), and could be placed on wooden strips for mounting in the switchboard on one-inch centers. The various changes in form through which the lamp bulb has passed are illustrated in Fig. 7, showing the gradual steps whereby the size of the bulb has been reduced until, as shown in Nos. 11 and 12, the present lamp occupies no greater volume than that required by a spring-jack and may be inserted into sockets composed of pairs of springs arranged on a rubber strip. Such sockets so closely resemble standard spring-jacks that they are called "lamp-jacks," for they occupy the same space, and may be secured in the switchboard in the same manner. By placing alternate strips of lamp sockets and jacks, the subscriber's line signal and answering jack may be more closely associated than has previously been possible, space economized in the switchboard and service accelerated.

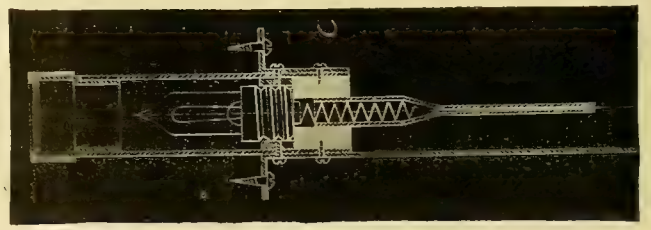


FIG. 8. EVOLUTION OF THE LINE SIGNAL.

At first it was considered desirable by lamp manufacturers to preserve a large volume in the bulb of the lamp in order to secure an adequate vacuum. To attain the desired compactness the bulbs of the lamps were made smaller and longer, as is shown in Fig. 7, numbers 2 and 7 inclusive. Gradually, improvements in manufacture were sufficient to reduce the bulb of the lamp to a smaller diameter than that of the screw base, and it at once became apparent that some other method of securing the lamp in its socket would still further contribute to compactness. The next step was the construction of an exceedingly small bulb lamp, shown in Fig. 7, No. 13, which was secured to a wooden base carrying two metal rings to which the leading-in wires of the lamp were soldered, the complete lamp being shown in Fig. 7 at 8. Whether the theory that the small-sized bulb militates against a sufficient vacuum is correct, or not, it has been impossible to definitely ascertain, but experience has shown that lamps having bulbs as small as is indicated in No. 13 were not so successful as large ones. In order to retain the compactness thereby attained, a long and slim bulb was made, as shown in Nos. 9 and 10. In this lamp an additional advantage was secured by placing the filament at the end of the glass opposite the seal. This end could be blown hemispherically and quite thin, thus allowing a maximum of light to be transmitted. Lamps of this description were chiefly

made for four-volt circuits, the filament consisting of a very thin thread of carbon stretched between two platinum wires. These leading-in wires were fused through the sides of the bulb and soldered to two bits of thin copper forming the contact strips that were cemented to the glass tube. Some difficulty was experienced in the peeling off of these pieces, and, in addition, the amount of platinum in the leading-in wires was so great as to considerably increase the cost of such lamps. So, from motives of economy, a partial reversion toward earlier forms has taken place in the present standard lamp, as shown in Fig. 7, Nos. 11 and 12. The bulb is a glass tube about one-fourth inch in diameter and 1⅛ inches long. For four-volt lamps a straight filament is used, but for all others a horse-shoe shape. Only sufficient platinum is employed in the leading-in wire to pass through the glass, and in other respects the general details of manufacture correspond closely to the best practice in standard lamp construction. The base of the lamp is a bit of boxwood, so shaped as to readily enter the springs forming the socket, and arranged to prevent the lamp from turning as it is pushed into place. The earliest lamps were all designed for low-voltage circuits, rarely more than four volts. Presently it became apparent that lamps of longer life, together with an economy in conducting circuits, could easily be attained by the use of higher voltages, and the next advance was secured by making lamps for 10 and 20 volts, while at present 12 and 24-volt lamps are standard.

Telephony in Sweden.

H. T. Cedergren, managing director of the General Telephone company of Stockholm, Sweden, has devoted about three weeks to an inspection of the principal telephone systems of the Bell and the independent telephone interests of the United States. He made a careful examination of the system now in use by the New York Telephone company. He was also in Chicago for several days and he visited St. Louis and inspected the switchboard and plant now being installed by the Kinloch Telephone company in that city.

Mr. Cedergren is one of the most successful telephone men of the world. He organized the company and began the telephone exchange business in Stockholm about 15 years ago, in competition with the International Bell Telephone company, and his company has also for many years been in competition with the Swedish government exchange system in Stockholm. Notwithstanding this competition, the General Telephone company has had a steady growth since its inception, and has now about 16,000 subscribers in Stockholm, with a population of about 270,000. The last official report at hand is for the year 1894, when the plant and assets of the company had increased from the earnings on an original investment of about $150,000 to a total value of about $1,500,000, or to the extent of about tenfold, besides paying eight per cent. dividends on the original investment, which is all the dividend allowed by law. This has been accomplished with a maximum subscribers' rate of only about $27 per annum. The secret of the success of the Stockholm company seems to have been careful management, the best service possible and a rate which, while large enough to be fairly remunerative, is yet so low as to insure almost universal use of the telephone.

The plan has been followed in Stockholm of bringing a large number of lines into each exchange center. The company is now rebuilding the system and consolidating three of the former branch exchanges into one exchange. For the purpose of bringing many lines into one exchange center Mr. Cedergren has adopted the use of a cement block conduit for underground cables, in which there are tubes or holes for 77 100-conductor metallic-circuit cables. He also uses blocks with tubes for seven cables. Two views, showing these conduits in trenches in the streets of Stockholm, are presented in the accompanying cuts, which were reproduced from photographs recently taken for Mr. Cedergren.

TELEPHONY IN SWEDEN.—SEVENTY-SEVEN DUCT CONDUIT.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

Dr. Rogers of Stratford, Ia., is putting in a farmers' exchange.

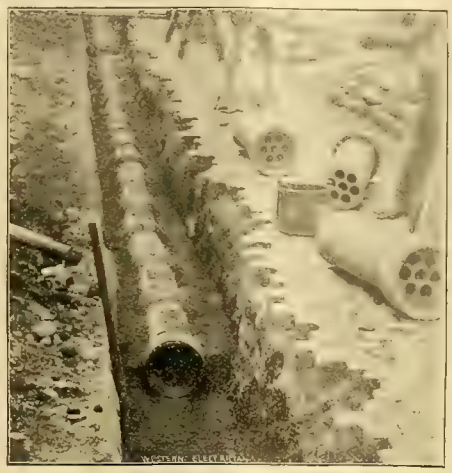
Cresco's telephone system is in operation.

The Minnesota Central Telephone company's lines were brought into Minneapolis August 1st; the company is also extending its lines along the Soo road.

About 2,000 subscribers in Bay City, Mich., and the valley are patrons of the newly established Valley Telephone system.

The line of the Standard company between Cresco, Ia., and Decorah, is in operation.

The La Crosse Board of Public Works ordered all telephone lines into the city hall to be brought in through the attic.



TELEPHONY IN SWEDEN.—SEVEN DUCT CONDUIT.

C. C. Lashaway of Chippewa Falls has succeeded Manager William Richards of the Bell company at Menomonie.

The Mankato Citizens' company will put in its plant at once.

A new copper line will be installed by the Bell company between Ames and McCallsburg, Ia.

J. R. Watson of the Citizens' company, Milwaukee, says 3,000 subscribers must be secured before beginning operations.

A special election will be held at Le Mars, Ia., August 30th to decide the question of granting to W. A. Houts, trustee, a franchise for another telephone system.

The Midland Telephone company of Adrian, Minn., has been incorporated at St. Paul.

After a flurry the South Dakota Board of Equalization decided on a flat levy of 32 mills on telephone companies in lieu of all other taxes in the state.

The Wisconsin Telephone company has reconstructed the Rhinelander system.

C. C. Brown, Thomas Hynes and M. H. Culbert have organized and incorporated the Kendallville and Cresco (Ia.) Farmers' Telephone company.

The Iowa company is occupying its new Keokuk quarters in the library building.

Citizens of Wellman, Ia., welcomed the advent of the lines of the Iowa Telephone company the first week of August. The rate to Chicago is $3.75.

Within a few weeks the Jefferson Telephone company will have direct connection with Sioux City.

The exchange at Dysart, Ia., is now in operation; also the Humeston exchange.

Commissioners have been named at Wadena, Minn., to appraise damages for the extension of the Northwestern exchange.

The Union Telephone company has completed a line from Reedsburg, Wis., to Richland Center via Loganville.

The Iowa and South Dakota company is building a line to Struble, Ia.

Traer, Ia., has 40 telephones on its new line.

The Cedar Valley, Ia., company is assessed at $6,000.

Marshalltown, Ia., reports 100 new subscribers for the Iowa company.

Benson, Minn., will soon have two telephone lines, one of which is the Northwestern.

Fred. Kron has resigned as director of the Mankato Citizens; Dr. J. H. James has been elected vice-president and W. D. Willard director.

A People's telephone exchange has been organized at New Richmond, Wis., with Charles N. Gorham president. A. J. Presson has the contract to build the line.

Work is going on rapidly on the new line, Riverside, Lone Tree, Kalona and other places near in Iowa.

A local amalgamation projected is that of the New Prague-Heidelberg and New Prague-Wesley line with the Home company of New Prague, Minn.

The Iowa Telephone association met at Des Moines August 10th to readjust toll-line rates.

The independent Iowa companies met the short-distance rate cut of the Bell, and the schedule changed from county to mileage basis as follows: 20 miles, 20 cents; 30 miles, 25 cents; 40 miles, 35 cents; 60 miles, 45 cents; 75 miles, 50 cents, over five-eighths of a cent a mile.

The Iowa company will extend a line from Bradgate to Rolfe, Ia.

A telephone line between Odebolt and Berne, Ia., is projected.

Connection will be made by the Blue Earth Valley company with the Western Electric, New Ulm and local system at Mankato.

When complete with connections the new Central Dakota Telephone company will give Aberdeen connection with Sioux Falls, Madison, Yankton, Pierre and Brookings. Construction will be pushed.

Manager Freedy of the Northwestern Telephone company at St. Paul testified that there had been found in one junk shop 977 pounds of stolen cable.

Cambridge, Minn., is now on the line of the Northwestern Telephone company.

W. B. Douglas, Warren Carlisle and W. P. Lathrop have filed articles at Omaha of the Trans-Mississippi Telephone company; capital, $10,000.

Work will soon be commenced on Northwestern exchange extensions north from Grafton to Neche, to Pembina and Larimore to Langdon; connection will be made with Crookston.

The Central Union company of Iowa has posted notices that it will pay the war tax of a cent a message and not raise rates.

The Western Electric Telephone company is considering an extension from Albert Lea to Clark's Grove, Geneva, Cooleyville and other points in the northeastern part of the county.

Extensions and Improvements.

The Citizens' Telephone company of Spartanburg, S. C., has been incorporated, with a capital stock of $8,000, for the purpose of building and equipping a telephone exchange.

The Capay Valley Telephone company has been organized and has made application for a right-of-way over the county roads to erect and maintain a telephone line from Rumsey to Woodland, Cal.

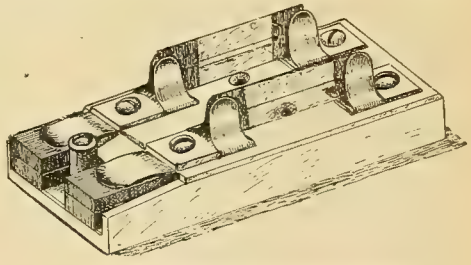
The Western Telephone Construction company of Chicago has issued a circular devoted to party-line service. It contains much practical information and many working diagrams that should prove of interest and assistance to small companies.

The Home Telephone company of Columbia City, Ind., has closed a contract with the Sterling Electric company of Chicago for a 200-drop section of the standard metallic Bell type board, to replace the apparatus now in use. The company also contracted with the Stromberg-Carlson Telephone Manufacturing company of Chicago for 150 standard instruments to replace those now in use there.

Combined Fuse Block and Lightning Arrester.

The telephone department of the Electric Appliance company, Chicago, has just put upon the market a combined fuse block and lightning arrester. This is an article of merit and will demand the attention of telephone exchange managers. It is 4¼ inches long by 1½ inches wide. The illustration herewith gives a fair idea of its appearance.

Absolute protection is said to be secured from burn-outs from crosses caused by trolley and electric-light lines breaking and falling across the telephone wires, by the use of this device. It is claimed to be a positive lightning arrester and practically indestructible. It requires no attention. A light-



COMBINED FUSE BLOCK AND LIGHTNING ARRESTER.

ning discharge across the carbon blocks produces a small amount of carbon dust; this can easily be removed by pulling out the carbon blocks and blowing out the dust, then replacing them, and the arrester is in working order again.

The fuse end of the arrester should always be connected to the wires running to the instrument to be protected, and the carbon arrester end directly to the line wires. The lightning arrester, part of this block, is constructed with two carbon blocks with perforated mica separating them. One block rests on the ground plate and the other is connected directly on the line, the idea being to produce an arrester on the air-gap principle. The perforations in the mica separator produce this result when the carbon blocks are placed in their proper position on the arrester.

The fuse portion of the arrester can be furnished with either the Postal or Western Union type terminals, an ordinary two-inch copper or foil terminal fuse being used. The base is made of porcelain

WAR NEWS.

[*Continued from page 105.*]

structions from the Navy Department would follow. Captain-General Blanco, as the War Department learned afterward, let the cipher message go through, accompanied by a telegram of instructions to the commandant at Manzanillo to have the despatch delivered to the American naval commander immediately.

Regular cable communication between Key West and Havana has been resumed on the basis that existed before the war, with the exception that a censorship of press dispatches will be exercised at the Florida end of the line. The cable will remain open for the use of the Spanish and United States governments and of private individuals during the period of armistice. The first important message sent overt he cable was a dispatch from Sagasta, the Spanish premier, to General Blanco, informing him officially of the armistice proclamation and instructing him to suspend all hostilities. Sagasta also sent a message to the same effect to Captain-General Macias in Porto Rico. Both governments by mutual agreement, may send cipher messages over the Havana-Key West cable, but the messages must be regularly addressed to officials and signed by officials.

Miscellaneous Notes.—The Norwegian steamship Adria, which has been used in cable laying near Santiago by the signal corps of General Shafter's army, has arrived in New York from Key West. She will be turned over to her agents, as the government requires her no longer. Her force of men, who are still with the army at Santiago, consisted of two sergeants and 10 privates. She was also used as a supply ship, carrying telegraph and telephone outfits for service in the field.

On the Texas, which has just been refitted at the Brooklyn Navy Yard, is an interesting souvenir. It is one of the Vizcaya's fine big searchlights. One of the searchlights on the Texas was smashed in the naval fight; so, after the Vizcaya gave it up, Captain Philip decided to appropriate one of her searchlights, which he did. On a brass plate on this searchlight is engraved: "Taken from the Spanish armored cruiser Vizcaya, off Santiago de Cuba, July 3, 1898." Captain Philip says the searchlight is a very fine one.

The Telegraph Age relates this incident: "The Spanish forces occupying Santiago de Cuba having refused to surrender the city and its fortifications, Major-General Shafter, commanding the American forces, notified all non-combatants in the city to leave within 24 hours, as he proposed to bombard it. The cable operators employed by the West Indian and Panama Telegraph company decided to go on board a British man-of-war. One of their number, being seriously sick, was refused admittance to the ship. Thereupon two others, Operators Cavanagh and Froome, agreed to remain with him. Later on they had him carried within the American lines, where they attended to his wants."

The Canadian Bell Telephone company appealed from the decision of a board of three county judges affirming the decision of the Court of Revision for the city of Hamilton, Ont., whereby the assessment of the appellant for 1898 was confirmed. The part of the assessment in question upon this appeal was that upon the poles, wires and conduits of the appellant, at $13,490. The appellant complained of the assessment of these articles as real estate, and also contended that it was excessive, the value for assessment being determined by taking the gross cost and deducting 15 per cent. for wear and tear. The Court of Appeal held that the equipment could only be taxed for the abstract value as raw material.

The Edison Store in New York.

Upper Broadway has no finer modern office building than the St. James, at the corner of Twenty-sixth street. Its 16 stories tower up above everything in the neighborhood. The ground floor corner store is shown in the picture, and gives one an idea of the pleasing architectural effects which make the structure attractive. The facades on both Broadway and Twenty-sixth street are of light sandstone and red brick.

The store itself has a floor space of some 5,000 square feet. Over the front entrance is a graceful glass awning, which, together with the broad show windows, make the lighting as nearly perfect as possible. At night the illumination of the store is a flood of radiance, as befits the company headquarters of Thomas A. Edison. A fac-simile of Mr. Edison's signature is executed on the dark background of the signs over the doors in miniature incandescent lamps. Nothing could be more attractive than the exterior, and nothing more satisfactory than the interior. The store is high and broad and long. Down the center is a row of massive gilded columns. The walls are done in Pompeiian red, the ceiling and cornices are of antique ivory finish. Fittings of polished oak with frosted glass in doors and partitions separate the spacious offices from the main room. The hardwood floors are carpeted with broad strips of Axminster, giving an air of luxury and elegance usually found in boudoir or drawing room, and not looked for in a show room.

Down stairs, the basement is as large as the store itself. Under the sidewalks are the wrapping and packing rooms, and also the adjusting and testing departments. There are a number of small rooms fitted up cosily, where buyers of records for phonographs may hear them undisturbed. A stock of 15,000 makes buying easy; you can always get just what you want. There is also in the basement a fine "dark room," 50 feet long, permitting the proper display of moving picture films for the projecting kinetoscope, and a special show room for X-ray demonstrations, where the wonders of the cathode ray are exhibited, together with all the special apparatus used.

It is worthy of note that the goods displayed do not suffer by reason of their gorgeous setting, for their excellence, perfect finish and high grade warrant every penny of expenditure in making this room one of the most attractive salesrooms on Broadway. The entire line of Edison phonographs is exhibited, from the most complete and costly down to the popular priced latest invention, the "Standard." Edison fans of various styles and sizes make the hottest day livable. All types of the effective Edison-Lalande batteries are shown, while dental motors and a most complete line of electro-medical apparatus are the envy of every doctor or dentist who visits the store to see the very latest developments in the art.

A corps of polite and attentive salesmen is always ready to explain and demonstrate the interesting apparatus displayed. Visitors as well as buyers are made heartily welcome.

THE EDISON STORE IN NEW YORK.—EXTERIOR.

THE EDISON STORE IN NEW YORK.—INTERIOR.

COMMUNICATION.

Failure of Water Power on Pacific Coast.

To the Editor of the Western Electrician:

Referring to an editorial in the Western Electrician of July 30th, wherein you mention the failure of the water supply of the San Joaquin Electric company, permit me to say that your surmise "that an unusual condition prevails on the coast" is correct. While the San Joaquin Electric company was the only transmission company in California mentioned in the public press and hence the only one to gain notoriety for shortage of water, all of the other transmission plants of the state have been likewise crippled by the extreme drought.

The condition that prevails in the present season occurs in California about once in thirty years, the present season being the shortest in precipitation since 1864. Through all ordinary years and even moderately dry ones the natural flow of water available to the San Joaquin Electric company is abundant for its present load, but, for meeting such emergencies as the past season, reservoirs have been constructed which it is intended to keep full of water and thus prevent for all time any repetition of the present shortage, regardless of the climatic conditions. As the company had just been started and was making important extensions, the construction of reservoirs was left for a future consideration, inasmuch as up to the present year there had been no shortage in the water supply. The company has a reservoir completed, but was unable to fill it on account of its being constructed too late in the present season, although it can be filled in any season no matter how dry.

The quotations in your editorial are evidently

taken from the popular article in the Fresno edition of the Journal of Electricity of San Francisco. I will state in explanation that the 50,000 horse power of water available is to be provided by an enormous water storage reservoir and that the flow is sufficient in the streams, taken year after year, to leave the reservoir full as an emergency supply.

The reservoir that was built at the time the plant was installed has never been considered by us more than a simple settling basin and a supply to last during the temporary shutting off of the water in the canal to make necessary repairs, and to this end it has given excellent satisfaction, and also to accumulate surplus waters in cases of shortage, such as the present time.

It is but fair to our company, that has been given such wide notoriety through your large subscription list and that of the San Francisco Chronicle, that it be made known that the San Joaquin company is furnishing at the present time a greater percentage of its capacity in power than any other transmission plant in the state, excepting those furnished with large storage reservoirs, with which this company is now provided, and hence the condition will never recur of a shortage of power during the dry season. The water for this plant is used under a head of 1,400 feet, hence a very little water stored represents a great deal of power, and this again accentuates the value of high head installation, especially when there are opportunities for extensive storage on the headwaters of the streams that supply them. The streams supplying the San Joaquin Electric company have numerous favorable reservoir sites that it is intended to develop as the water is required in future extension.

JOHN S. EASTWOOD,
Vice-President.

Fresno, Cal., August 6 1898.

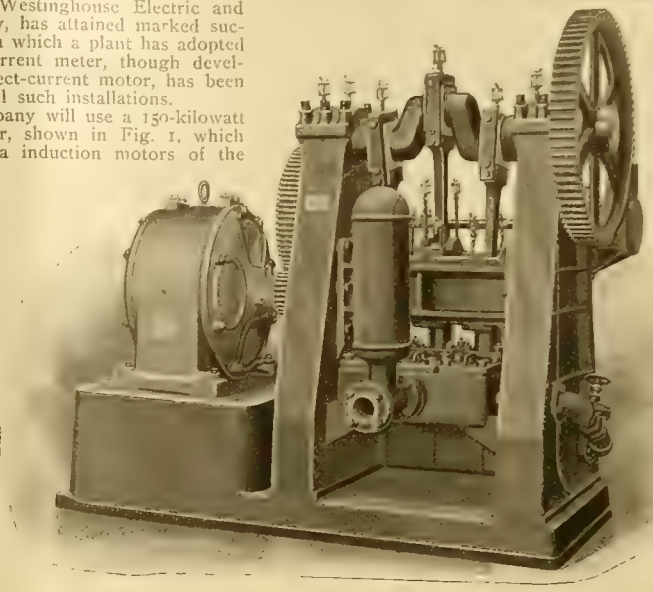
Concentration of Power by Electric Transmission.

One of the most forcible of the advantages of electrical transmission of power is that this method often makes it possible to combine two or more steam plants into one, greatly diminishing the cost of labor and supplies. Such an advantage appeals especially to the mill owner, who may operate shafting in several buildings or departments by separate sources of power. A conspicuous example of this wasteful arrangement is in the works of one of the largest locomotive shops of the country, where part of the plant is operated by water power, part by steam power and part by compressed air, the latter necessitating an extra engine and compressor.

Electric transmission has made it possible to centralize the power in such shops. When Lieutenant L. O. Garrett took charge of the affairs of the Atlas Tack company of Taunton, Mass., as manager, he instituted a thorough investigation as to the power required for the several classes of tack-making machinery under normal conditions. The mills of this company at Taunton are three in number, located from 800 to 1,200 feet apart, and were, until recently, operated by three separate steam plants, with the accompanying wastefulness incident to small units. It was found that, owing to variations in the amount of power required from day to day for the different classes of work, the duty of the three steam plants could be easily performed by a single steam plant of two-thirds their united capacity.

So large a saving in coal and labor as was expected from this arrangement induced Lieutenant Garrett to engage the services of T. W. Sprague of Boston to investigate jointly with him the best systems of transmission. A personal inspection was made of a number of the principal polyphase plants among the New England mills, which resulted finally in the adoption of the Westinghouse three-phase system of 3,600 alternations, as being most suitable for the work of the Atlas Tack company. This system, in connection with the Tesla "Type C" motors, made by the Westinghouse Electric and Manufacturing company, has attained marked success in every instance in which a plant has adopted it, and the alternate-current meter, though developed later than the direct-current motor, has been favorably received in all such installations.

The Atlas Tack company will use a 150-kilowatt Westinghouse generator, shown in Fig. 1, which will operate nine Tesla induction motors of the type shown in Fig. 2, ranging from three to 50 horse power. The gas-lighting system of the mills will be replaced by about 1,000 incandescent lights. The company instituting these changes is one of the most progressive of manufacturing concerns, employing over 500 men, and making some 10,000 brands of tacks, rivets, etc. Considerably over 50 per cent. of all the tacks and rivets made in the United States are produced at these shops. The electrical equipment will be watched with interest, and no doubt imitated by many other concerns of the same kind.



INCREASING USE OF ALTERNATE CURRENT MOTORS.

Increasing Use of Alternate-current Motors.

The old-time prejudice against the alternate-current motor has become nothing more than history. As the original promoters of the use of alternating apparatus, the Westinghouse company has been pre-eminent in the developments of machinery of this type. The culmination of these efforts is presented in the Tesla "Type C" induction motor, the essential feature of which is the absence of any connections between the mains and the rotating parts. The installation of these motors by the Silver Springs Bleaching and Dyeing company of Providence, R. I., has demonstrated their fitness for a peculiar service in which the use of direct-current motors would be impossible, it is claimed, and power. Two years of active service, under most trying conditions, have fully demonstrated the soundness of engineering judgment exercised.

In addition to lighting the entire plant, 30 Westinghouse induction motors of from three to 75 horse power have been installed. These motors are employed for driving washing machines, tentering frames, trip[illegible] ing machines, centrifugal separators, ventilators and ventilating fans. Some of the motors operate constantly in a cloud of steam; many of them are subjected constantly to the action of chloride fumes, and all the copper parts of the motors and switches are green with corrosion. In many of the operations enormous starting torque is required, the initial torque in some cases being four times the normal torque of the motor. The plant has proven so satisfactory that it has recently been extended by an installation of 10 more of the Tesla "Type C" motors, made by the Westinghouse company.

South African Exhibition.

An exhibition of the products, manufactures and mineral wealth of the various states and colonies of South Africa will be held in Grahamstown from December 15, 1898, to January 21, 1899, in connection with a display of the manufactures and merchandise of other countries which are or could be imported into the region. The machinery department will be on a large scale and fully equipped. The hall will give accommodation to the largest and most attractive collection of machinery ever exhibited in South Africa. The practical application of electricity will have especial attention, and the advances made in this art will be made apparent. The buildings and extensive grounds will all be brilliantly illuminated. Exhibits from abroad will be brought from any port in the colony in bond, carriage free, and will not be subject to duty unless they are sold. It is expected that the steamship companies will carry exhibits from abroad at reduced rates. The trade of the United States with South Africa is steadily growing, especially in all kinds of machinery. No doubt this exhibition, known officially as the South African Industrial and

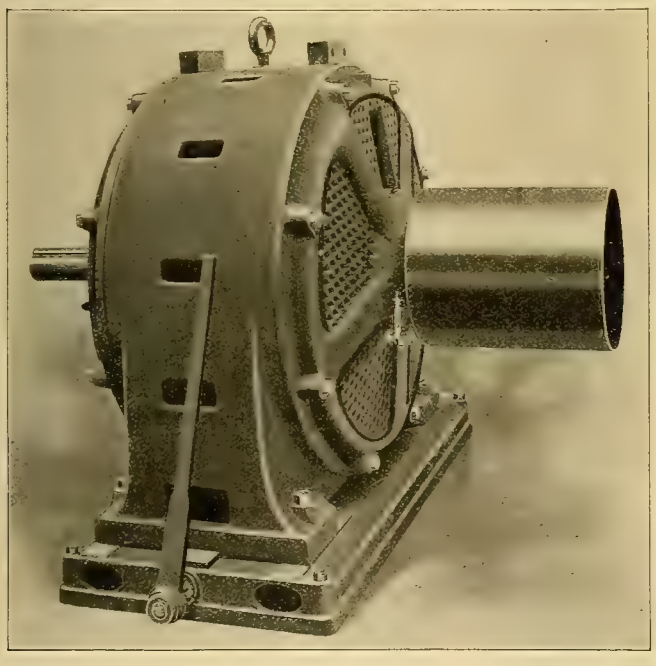


Fig. 2.

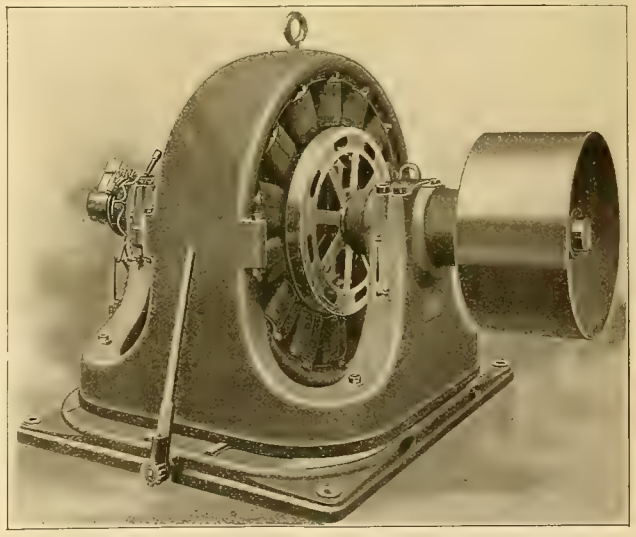


Fig. 1.

CONCENTRATION OF POWER BY ELECTRIC TRANSMISSION.

Arts Exhibition, will be well worth the attention of American manufacturers. The Western Export Bureau, 185 Dearborn street, Chicago, can give further information about it.

American Street Railway Association.

The arrangements for the Boston convention of the American Street Railway association indicate that the meeting will be a thoroughly enjoyable affair. The programme will be an artistic production and in keeping with the event. The exhibition will be the largest that that has yet been held by the association. It has been decided to keep it open during the evening to enable the people of Boston to visit it. The entertainment will be on an elaborate scale and will be arranged by the Boston street-railway interests and the Massachusetts Street Railway association. Secretary Penington has arranged the order of exercises as follows:

TUESDAY MORNING.

Meeting called to order at 10 o'clock by Albion E Lang, president.
Calling of the roll.
Invitation extended to join the association
Address of the president.
Report of the executive committee.
Report of the secretary and treasurer.
Reading of paper on "The Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use." By Richard McCulloch, electrical engineer Cass Avenue and Citizens' Street Railway company. St. Louis, Mo.
Reading of paper, 'Municipal Ownership of Street Railways."

TUESDAY AFTERNOON.

Trip to Concord and Lexington.

TUESDAY EVENING.

Reception at the hall.

WEDNESDAY MORNING.

Reading of paper on "Maintenance and Equipment of Electric Cars for Street Railways." By M. S. Hopkins, electrician Columbus Street Railway company, Columbus, O.
Reading of paper on "The Carrying of United States Mail on Street Railways." By W. S. Dimmock, general superintendent, Omaha and Council Bluffs Railway and Bridge company, Council Bluffs, Ia.
Appointment of committee on nomination of officers and next place of meeting.
Ladies to be taken to points of local and historic interest.

WEDNESDAY AFTERNOON.

Excursion down the harbor with clambake at Nantasket Beach.

THURSDAY MORNING.

Reading of paper on "To What Extent Should Street Railway Companies Engage in the Amusement Business?" By Walton H. Holmes, general manager Metropolitan Street Railway company, Kansas City, Mo.
Reading of paper on "Inspection and Testing of Motors and Car Equipments by Street Railway Companies." By Frederick D. Perkins, electrical engineer Toledo Traction company, Toledo, O.
Election of officers.
Drive through the park for the ladies.

THURSDAY AFTERNOON.

Trip to Plymouth.

THURSDAY EVENING.

Annual dinner, Hotel Brunswick at seven o'clock.

FRIDAY MORNING.

Reading of paper, "Cost of Electric Power for Street Railways at Switchboard, both Steam and Water." By R. W. Conant, electrical engineer Boston Elevated Railway company, Boston, Mass.
Report of committee on standing rules for government of conductors and motormen.
Unfinished business.
Installation of officers.
Adjournment.
Shopping trip for the ladies, visiting principal stores.

FRIDAY AFTERNOON.

Trolley excursion to Norumbega Park.

The exact hour for holding the several entertainment features and the time and place of assembling for the numerous excursions planned will be announced each day at the opening of the business session.

Municipal Electricians.

The convention of fire and police telegraph superintendents and municipal electricians in Elmira, N. Y., last week, was well attended and successful. Several papers were read, and the membership dues were raised from five dollars to $10 a year. The treasurer reported a balance on hand of $240. The election of officers resulted as follows: President, J. W. Aydon, Wilmington, Del.; vice-president, G. T. Macdonald, Ottawa, Canada; treasurer, Adam Boesch, Newark, N. J.; secretary, H. F. Blackwell, Jr., New York; financial secretary, Burt McAllister, Bradford, N. Y.; executive committee, William Y. Ellett, Elmira; M. W. Mead, Pittsburg; W. H. Thompson, Richmond, Va.; William Brophy, Boston; F. C. Mason, Brooklyn. The next meeting will be begun on the first Tuesday in September, 1899, and Wilmington, Del., was selected as the scene of next year's convention.

Among those in attendance were: Frank C. Mason, Brooklyn; Frank P. Foster, Corning, N. Y.; Burt McAllister, Bradford, Pa.; H. F. Blackwell, Jr., New York city; Thomas J. Welsh, Buffalo; William A. Baines, Bridgeport, Conn.; Louis W. Miller, Rochester; Morris W. Mead, Pittsburg; H. C. Bundy, Watertown; William Brophy, Boston, Mass.; Frederick Pearce, New York; Lema Lemon and wife, Baltimore; Adam Boesch, wife and daughter, Newark, N. J.; Frank M. Ferrin, Boston, Mass.; W. H. Thompson, Richmond, Va.; J. W. Ogden, wife and daughter; T. J. Harper, Atlanta, Ga.; William Exall, Newark, N. J.; George T. Macdonald, Ottawa; William Crane, Erie, Pa.; S. L. Wheeler, Springfield, Mass.; A. C. Mackenzie, Elmira; W. Y. Ellett, Elmira.

CORRESPONDENCE.

New York Notes.

New York, August 15.—The Metropolitan Street Railway company has increased its capital stock from $30,000,000 to $45,000,000. The State Railroad Commission has also granted 18 applications of the company for permission to change the motive power on its various lines. Of the new stock, $5,000,000 will be held in reserve in the treasury. The other $10,000,000 will be distributed among the present stockholders at par in proportion to their present holdings. It is not expected that any part of this new stock will be placed on the market. The proceeds of the $10,000,000 of new stock issued will be used to retire certain outstanding obligations of the Metropolitan company to meet the cost of the extensive reconstruction of many of the present horse-car lines. President H. H. Vreeland says that when the entire Metropolitan system has been perfected as planned, it will be possible for a person to ride from any part of New York to any other part of the city reached by these lines without change of cars. Further, Mr. Vreeland is quoted as follows: "In the morning, when business men are eager to get down town, we will run a large number of cars quickly and directly into the business section from every point up-town. Cars from Second avenue, Lexington, Madison, Sixth, Eighth, Columbus and Amsterdam avenues will all turn into Broadway at convenient points. Early in the evening, when the business man wants to get home, he can take a car downtown that will carry him without change wherever he wants to go on any of the up-town avenues. We shall also be able to provide systematically for the convenience of the shoppers in the afternoon. At certain hours a large proportion of the cars on the up-town lines will be run direct to the shopping district. Cars from Amsterdam, Columbus, Eighth, Madison and Lexington avenues will be run through Fifty-ninth street and down Sixth avenue, and back again. During the evening, when people want to get to the theaters, all of our up-town lines will converge into Broadway."

The Kings County Elevated Railroad company will, it is said, commence operating cars over the Brooklyn bridge on August 23d. Twenty motor cars will be used for this service.

John Corcoran, a lineman employed by the New York and New Jersey Telephone company, while on the way to South Beach on Saturday, received instructions to repair a broken wire at the corner of Zebra avenue and Richmond turnpike. Richard Walsh, another lineman, 25 years old, of Tompkinsville, lived nearby, at 130 Richmond turnpike, and Corcoran asked him for a ladder and some wire. Walsh volunteered to do the repairing himself. He had just climbed the pole and begun his work when he put his hand on an electric-light wire and received a severe shock. He hung on the wire for a few seconds and then fell to the ground. Corcoran carried him to the Smith Infirmary, one block away, where he died a few minutes later. Walsh was unmarried. M. S.

Northwestern Notations.

Minneapolis, August 13.—The storm of August 6th stalled about 30 cars at St. Paul and melted wires. The feed wires on the Como line, in the Minneapolis power house, were burned and the line was useless for 45 minutes. The lightning arrester was burned from a Como car.

Rapid progress is being made on the interurban line at Eau Claire. Work at the Chippewa Falls end is not going on, but about six miles has been constructed from the Omaha depot at Eau Claire.

An amended complaint in the National Electric Works case at Eau Claire charges Peter Truax, W. A. Rust, H. C. Putnam, E. B. Putnam, David Drummond, Carl Kammeyer, Eugene and M. G. Shaw and A. F. Hollingshead with a liability to pay $50,000 for the creditors for value of stock.

John J. Schoenleber of the Northwestern Engineering company's electrical supply office died at St. Joseph's Hospital.

South Omaha authorities are going to make another attempt to compel the railroad companies to light their crossings with arc lights.

The Water and Electric Power company has received permission to enter the city of Helena and sell electric power at wholesale, its contract with the local company preventing it from doing a retail business.

A new one about Thomas Lowry is that he has got a right-of-way entirely around White Bear Lake, near St. Paul, and intends to embrace the lake.

The Escanaba Electric Railway company was reorganized, with A. R. Moore as president and manager. In 90 days connection will be made at Wells with the Soo line, and there is talk of an extension to Gladstone.

The contract for a system of waterworks and electric lights at New Paynesville, Minn., has been let to W. I. Gray & Co., Minneapolis.

The Electric Light and Power company's dam at Maquoketa, Ia., leaks badly, and Senator Hurts may be engaged to repair it.

In a squabble over its bill against the city of Maquoketa, Ia., the Barnes Electric company stated that it was customary to allow for 10 per cent. of lights being out of order.

Bids of $4,000 and thereabouts were considered too high by the Barron, Wis., Council for an electric-light plant; about $2,000 is considered a fair price.

Kearney, Neb., is again to be lighted by electricity.

A Corliss engine and a new system of arc lights will probably be added to the equipment of the Mount Pleasant, Ia., plant.

Anaconda, Mont., is receiving bids for furnishing electric-arc lights for the city during a term of five years. All bids must be in by September 5th.

A levy of $5,000 has been authorized at Wausau, Wis., for an electric-light plant. C.

PERSONAL.

Professor W. M. Stine has accepted the Williamson chair of engineering at the Swarthmore College, Philadelphia, and will have charge of the electrical and steam-engineering departments in that institution. Professor Stine has many friends and admirers in Chicago who will regret his departure. His aim has been to raise the standard of engineering work, and he has assisted materially in bringing this about.

It is now considered possible that the remains of John Mason Jackson, the secretary and treasurer of the Western Electric company, who died in Hawaii on July 6th, will be removed from the Honolulu cemetery to Chicago at some future time. Mr. Jackson's will was filed on August 10th. The beneficiaries are the immediate relatives and several Baptist institutions. Among the latter are the University of Chicago, the First Hyde Park Baptist Church, the American Baptist Missionary Union of Boston, the American Baptist Home Missionary society of New York and the American Baptist Publication society of Philadelphia. John B. Jackson and Enos M. Barton, the executors, estimate the value of the estate at $96,000. The estate is to be held in trust until 1904, or until after the death of the parents of the deceased. It is then to be divided.

The Ottawa (Ont.) correspondent of the Western Electrician writes, under date of August 13th: "The board of governors of McGill University, Montreal, has appointed Professor R. B. Owens, E. E., of the University of the State of Nebraska, to the chair of electrical engineering at McGill." Professor Owens is one of the best known of the younger electrical educators of the country. He is a native of Maryland and studied in Johns Hopkins University of Baltimore and Columbia University of New York. He obtained the post-graduate degree of E. E. from the latter institution in 1891. For over six years Professor Owens has been connected with the University of Nebraska at Lincoln, Neb., first, as adjunct professor of electrical engineering, then as full professor and finally as director of the department of electrical and steam engineering. He was one of the judges of electrical exhibits at the World's Fair and is now completing his term of service as commissioner of the electrical section of the Trans-Mississippi Exposition at Omaha. He is a member of the American Institute of Electrical Engineers and other engineering societies, and is practical, up-to-date and progressive in engineering work.

ELECTRIC LIGHTING.

Mayor Martin of San Jose, Cal., recommends the erection of a street-lighting plant at a cost of $40,000.

The Monmouth Traction company has acquired a controlling interest in the Bordentown (N. J.) electric-light plant.

Blyth parish church in England, built in the year 1080 and said to be a remarkably fine specimen of Norman architecture, is now lighted by electricity.

The Spartanburg (S. C.) Gas, Electric and Street Railway company will expend about $150,000 in improvements. A water-power plant will be built to generate electric power. The New York office of the company is at 100 Broadway.

A lady—Mrs. Almira Swift—is president of the Swift Electric Light company of Saginaw, Mich., which supplies current to 158 arc lamps and nearly 5,000 incandescents, as well as to a number of power motors. The affairs of the company seem to be well conducted, and it is said to be in a prosperous condition.

The electric-light plant at Parkersburg, Iowa, installed by F. H. Stanard, will be ready to be put in operation next week. The plant is a 220-volt direct-current system of 45 kilowatts capacity. Mr. Stanard has also a contract to install a 50-kilowatt system at Cresco, Iowa. Work will be begun there within two weeks.

The Potomac Electric Light Power company of Washington, D. C., has secured the contract for the lighting of Lafayette, Franklin, Judiciary and Lincoln parks, four of the largest parks in the city; the price is 25 cents per light per night. The lighting contract for the lighting of the White House Park has not yet been awarded.

A curious case has just engaged the attention of the Scotch law courts. The Edinburgh Town Council has recently changed over from 115 to 230 volts as its pressure at consumers' lamps. It applied to one of its customers for permission to make the change, telling him that the only cost to him would be that of higher voltage lamps. After making the change, it was found that the insulation of the installation was not good enough for the in-

creased pressure, and the supply was cut off until the premises were rewired. The corporation disclaimed liability for this expense, so the customer sued for the amount, which was £143 18s. 9d. After hearing evidence and counsel on both sides, the judge decided against the corporation, which thus became liable for the amount.

ELECTRIC RAILWAYS.

A new trolley line is projected in Philadelphia, to extend from Germantown to the Falls of Schuylkill.

Every steam locomotive has been withdrawn from the Alley "L" road in Chicago, and the line is now operated entirely by electric power, using the Sprague system of multiple control on the cars.

Franchises for 50 years have been granted for an electric railroad to be built along the public highway from Harvard, Ill., to the head of Geneva Lake, Wis. The company proposes to carry freight and will build a road suitable for heavy cars.

The Marion City Railway company of Marion, Ind., has completed its interurban line from Fairmount to Summitville. This, with the line of the Union Traction company of Anderson, gives a continuous electric road between Anderson and Marion, about 35 miles.

The city of Port Angeles, Wash., has given a franchise to the Port Angeles and Eastern Electric Railroad company to build in the city. William Martell and John Lehmann are interested. The road must be completed from Port Angeles to some point on the Port Townsend Southern within 18 months.

The Milwaukee Electric Railway and Light company has let contracts for an addition to its power house on River street, to cost $600,000, and be completed by December 31st. The building will cover a lot 130 by 100 feet, between the Milwaukee River, Oneida and River streets, and will be two stories high. The company has recently opened a new trolley line to Whitefish Bay by way of Oakland avenue, and has abandoned the old dummy line.

The Rochester and Sodus Bay Railway company was incorporated at Albany, N. Y., last week. The road is to be built and operated from the United States pier or adjacent thereto at Sodus Point, Wayne County, to the city of Rochester. Its length is to be 41 miles. The amount of the capital stock of the new concern is $1,000,000, divided into 10,000 shares. The names of the directors for the first year are: George E. Merchant, Walter B. Duffy, Thomas J. Nicholl, John C. Woodbury, George Wilder, Nathaniel Foote, A .Masters McDonnell, Joseph H. C. Tone, Ira M. Luddington, George Wilson, Charles Van Voorhis, of Rochester, and John A. Sullivan, New York. The principal office is to be located in Rochester.

The Boston Elevated Railroad company, which controls all the lines formerly operated by the West End Street Railway company, has ordered from the Corliss Steam Engine company of Providence, R. I., a 4,000 horse power vertical cross-compound Corliss engine for its central power station on Albany street, Boston. This engine is to be direct-connected to a 2,700-kilowatt 550-volt Walker generator, which will supply current for surface lines. The engine will run at 75 revolutions per minute. The cylinders are 42 and 90 inches by 60 inches. The present boiler plant is of sufficient capacity to supply the new engine. The power station at present contains eight General Electric generators, ranging in size from 1,200 to 1,500 kilowatts each. Stone & Webster of Boston, the consulting engineers of the company, have entire charge of the plant.

The strike of the employes of the Syracuse Rapid Transit Railway company was settled last week. The company has revoked the rule requiring old employes to make a deposit of $25 as surety and has agreed to receive at any time a grievance committee of its employes. The strikers waive recognition of the Amalgamated Association of Street Railway Employes of America, the purchasing of seven tickets of the Lakeside railway to sell to passengers, and all minor details. For two days and a half not a car was moved on the entire system, the only electric cars running in the city being those of the Suburban railway, the Lakeside railway and the Syracuse and East Side company, which are not affiliated with the Rapid Transit company. The settlement was arrived at through the efforts of William Purcell of Rochester and W. H. H. Webster of Buffalo, members of the State Board of Mediation and Arbitration.

A company with $300,000 capital, half of which is paid in, was organized in Detroit last week for the purpose of operating and constructing a suburban line that will connect Romeo and intervening points with Detroit. George B. Davis of Utica, well known as a member of the State Legislature from Macomb County, conceived the plan of building this road three years ago, and he has finally succeeded in organizing a company and getting assurances from the authorities of the different townships and villages through which the line will run that the necessary franchises will be granted. Under the present state law franchises cannot be granted to railroad companies until they have been incorporated. The name of this new concern is to be the Detroit, Utica and Romeo Railway company, and the fololwing-named stockholders are directors: Alexander A. McVittie, Frank E. Kirby, Frank D. Andrus and Elliot G. Stevenson of Detroit; George B. Davis of Utica and Marvil I. Brabb of Romeo. The remainder of the paid-up stock is held by Mr. Stevenson in trust for other stockholders. It is said that $45,000 in bonuses has been subscribed by the towns along the line. The company expects to have cars running over the line by the first of the year. If the kinetic compressed-steam motor, now in use on the Detroit and St. Clair road, proves a success, that motor will be adopted. Otherwise electricity from a power house conveniently situated will be the motive power.

POWER TRANSMISSION.

A company has been formed in Berlin, under the title of the Electric Power company of Santiago de Chile, with a capital of 24,000,000 marks. Extensive electrical undertakings in Chile are soon to be started by the company.

The work of establishing an electric power transmission plant at the coal banks at Lafayette, Boulder County, Colo., is soon to be begun. It is proposed to transmit to the mines of Boulder, Gilpin and Clear Creek counties, and perhaps to Denver. Many thousand horse power is used in the mining camps within easy distance of the Lafayette coal banks, so that there should be a good business for the company.

A note from Hot Springs, Ark., in the Manufacturers' Record states that the Ouachita Water Power company's proposed power plant is intended to supply power to street railways and lights for public houses and private dwellings. Engineers have been making surveys and other measurements preparatory to the construction of the plant. The entire cost is estimated at $250,000. For information address George M. French, designing engineer, or D. S. Ryan, 414 Central avenue.

ELECTRICAL SECURITIES.

The Commercial Cable and Telegraph company's stockholders have voted to increase the capital stock from $100,000 to $500,000.

The North Shore Traction company reports gross earnings for June of $137,161, an increase of $6,933 as compared with the same month of last year, and net $60,036, an increase of $6,449. For the nine months ended June 30th the gross earnings were $986,791, an increase of $35,289 as compared with the corresponding period of last year, and net $363,985, an increase of $12,009.

The Westinghouse Electric and Manufacturing company has authorized the issue of $3,500,000 15-year five per cent. gold debenture certificates, and has disposed of $3,00,000 of the issue, which will retire the outstanding floating and bonded indebtedness of the company, returning to its treasury, as available assets, stocks and bonds in various lighting and power companies yielding an annual income exceeding one-half of the interest charges of the debenture certificates.

The Boston Herald says: "About 9,000 shares of General Electric preferred stock have been deposited in the American Loan and Trust company to join with the committee in its legal issue against the vote of the common shareholders to scale their stock. About 1,000 shares were withdrawn under the permission recently given for withdrawals, but this was offset by another 1,000 shares deposited. The vigor of the preferred-share movement will not depend upon the size of the deposits."

The Columbus Street Railroad company reports gross earnings for June of $56,502, an increase of $5,284 as compared with the same month of last year, and net $28,939, an increase of $1,541. For the first six months of the year the gross earnings were $324,389, an increase of $41,489 as compared with the corresponding period of last year, and net $167,440, an increase of $20,035. The company also reports gross earnings for July of $60,198, an increase of $8,463 as compared with the same month of last year, and net $30,348, an increase of $3,915.

MISCELLANEOUS.

The Ottawa (Ont.) Electrical association has elected the following-named officers: Honorary president, T. Ahearn; president, J. Murphy; vice-president, B. Marchand; secretary, E .Bailey; treasurer, B. Nolan; executive committee, W. G. Bradley, E. J. O'Reilly, P. Grimes and J. Johnson.

The British Admiralty is stated to be considering an immense extension of electricity for the Portsmouth dockyard, at an estimated cost of £250,000. It is intended to abolish the old steam boilers and to drive the whole of the machinery by electricity, the generating station being the site upon which the convict prison stood.

The International Journal of Commerce, published by Schuldt & Gathmann of 56 Fifth avenue, Chicago, has made its appearance. It is designed to further the export trade of the United States in machinery, and brief descriptions of American mechanical applications are printed in English, German, French and Spanish. One set of illustrations of the machines described serves for the four sets of articles. The journal is to appear quarterly, and the publishers declare that it will be sent "to every country offering a field for American machinery of any kind."

The boilers of the British battleship Albion, recently launched at Blackwall, will carry a pressure of 300 pounds to the square inch, which will be reduced to 250 pounds at the engines. She will have 20 Belleville boilers fitted with special feed-water heaters or economizers. The Albion is a first-class battleship of the Canopus class. She is 390 feet long, with a load-line displacement of 13,000 tons.

In a recently published English book, "The Wonderful Century," the author singles out 13 "first-class inventions and practical applications of science," which the century has given birth to. These are railways, steam navigation, the electric telegraph, the telephone, friction matches, gas, electric lighting, photography, the phonograph, the Röntgen rays, spectrum analysis, anæsthetics and antiseptics.

A decision recently rendered by the Japanese Patent Bureau is of great importance to American inventors, as it decides that no foreign patent which has had prior registration in another country can be registered in Japan. This would seem to show that the protection supposed to be enjoyed by American and other foreign inventors under existing treaties does not exist, as the provisions of these treaties are wholly inapplicable to the patents already in existence, any of which can still be pirated in Japan.

The government of Victoria, Australia, has placed an order with the General Electric company of Schenectady for six Thomson recording wattmeters of 100 volts and varying capacities. These will be deposited in the Electrical Bureau of the Home Office of Victoria, and will be used as the official standards, by which all electricity meters used in the colony will be tested. In future no meters measuring electrical energy will be allowed to go into service in Victoria unless they agree with those just ordered and receive the final sanction of the Victoria government.

TRADE NEWS.

By a fire in the building at 67 and 69 Canal street, Chicago, occupied chiefly by the Chicago Belting company, on August 16th, a loss on stock and machinery estimated at $30,000 was inflicted. The company is said to be fully protected by insurance.

The Walker company, which is doing such a conspicuous share of the electrical business of the country, will make a fine display at the Boston convention of the American Street Railway association, to be held on September 6th to 9th. The list of exhibits is as follows: Section of Walker underground conduit system with car in operation; Walker No. 15 "L" railway motor in operation; Walker No. 15 "L" railway motor open to show construction; Walker No. 33 "S" motor mounted; Walker No. 33 "S" motor open; set of 33 "S" armature in various stages of construction; set of 33 "S" motor parts; Walker standard trolley; Walker standard railway switchboard panels with wattmeter; "S" controllers in operation; solenoid partitions open and in operation.

Work on the machine shop of the General Electric company at Schenectady was begun last week, when ground was broken for what will be a most important addition to the great manufacturing facilities of that company. The contracts were let to A. & R. Roberts of the Pencord Iron Works, Philadelphia, for the steel construction, and to J. J. Turner of Amsterdam, N. Y., for the masonry, etc. The cost of the new building is estimated at $175,000. The new machine shop will face on Central avenue, opposite building No. 15. It will be 653 feet long and 166 feet wide, and will be divided into three aisles; the central one having a width of 65 feet, the side aisles being each about 50 feet wide. The total floor space of this building will be not less than 144,250 square feet. It will contain the machinery necessary to handle the very large apparatus which the requirements of modern practice have rendered necessary. The need of such an addition to the manufacturing facilities of the General Electric company is realized after a visit to the factory at Schenectady at the present time. The many orders, both for large machinery and for large quantities of apparatus, are severely taxing the facilities of the company, and such has been the rush of orders that the traveler on the New York Central railroad as he passes the town at night sees at least half of the buildings lighted up and filled with employes busily engaged in pushing forward to completion the orders in hand. The working of night shifts has been carried on since the beginning of the year, and, according to the superintendent, there are few signs of the practice being abandoned for the present. It is expected that the new machine shop will be completed before the end of this year. The machinery will be driven by the current transmitted from Mechanicville, 17 miles distant. In addition to the new machine shop the General Electric company is making several important extensions to other buildings. The new foundry, which was recently begun, is now in position to receive the iron work, the supports for the great traveling crane having been erected last week. This building when finished will contain the largest foundry under one roof in the world.

BUSINESS.

The St. Agnes Hospital, Philadelphia, will have an electric plant. The engines, which are to be built by the Ball Engine company, Erie, Pa., are direct-connected to Eddy dynamos.

The Bibber-White company, 49 Federal street, Boston, Mass., has recently added more space to its wareroom, thus enabling it to facilitate the filling of orders, which are now attended to with great promptness.

The A. Beck Electric company, 303 Market street, St. Louis, makes a specialty of rewinding armatures. The company also does electrical and mechanical construction work, besides dealing in motors, dynamos and electric fans. Its specialty, however, is rewinding and repairs, and it solicits a trial.

The Illinois Electric company, 239 Madison street, Chicago, Ill., has just secured the exclusive agency for the Scheefer meters and transformers in the states of Michigan and Indiana, and is in a position to make prompt shipments and low prices. It advises the trade to secure its quotations before placing orders.

The F. & L. push flush switch is one of the most successful of the Electric Appliance company's smaller specialties. It is the smallest push switch on the market, the size of the face plate being only 1¾ by 3¼ inches. It also requires a very small opening in the wall, operates with but slight pressure on the keys and has many other valuable features, not the least of which is the fact that it is sold at a price considerably below the market for a push flush switch.

George A. Cragin, the agent for the Washburn & Moen Manufacturing company at Houston, Tex., has enlisted the services of a small army of attractive representatives in the form of miniature portraits of handsome women. These have been judiciously distributed among the trade, and Mr. Cragin will doubtless hear from them regularly.

The Ericsson Telephone company of 20 Warren street, New York, illustrates its goods in a catalogue which shows also a number of hardware specialties made by three other companies. The introduction contains this interesting statement: "Telephones are coming into such extended use that the hardware trade is rapidly becoming interested, and they are now recognized as a legitimate line of hardware." The great claim for the Ericsson Swedish telephones is that they are the "standard of the world."

Nearly all engineers are agreed as to the value of fuel economizers in steam-power plants under certain conditions. The economizer is designed to utilize the heat of the fuel gases, that would otherwise be wasted by passing off through the stack, in raising the temperature of the feed-water and thus effecting a saving in fuel. To secure the best results the economizer must be carefully designed and well built. The American fuel economizer, built by Broomell, Schmidt & Co. of York, Pa., is said to meet all the requirements of an ideal economizer. The manufacturers have lately issued a pamphlet describing their apparatus in all its applications, with much general information of value to steam users. The catalogue is an interesting one, and will doubtless be sent free of charge to any applicant.

The Farr Telephone and Construction Supply company of Chicago continues to do a large and increasing business. It is receiving orders from all over the country for its well-known telephone products, which have been received with marked favor by hundreds of the independent telephone exchanges. The Farr company will be glad to mail one of its new catalogues and hand-books of information (in which every independent telephone manufacturer will find something of interest) on request.

The Central Electric company of Chicago, which is acting as western distributer for the various types of Samson batteries, reports a large and continuously increasing use of this product. The Samson battery has attained an enviable reputation for use under conditions requiring the most exacting service. There has been quite recently introduced the new Samson semi-dry battery, which has become very popular by reason of its desirable features. This battery has extra heavy zincs and large carbons contained in a porcelain jar and sealed. Its ampere output is very large, and as it is portable, it is adapted for use under conditions where the former type of open batteries could not be used. The Central Electric company is carrying large stocks of all Samson types and is prepared to make immediate shipment on all orders.

ILLUSTRATED ELECTRICAL PATENT RECORD.

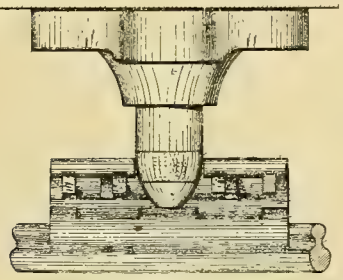
Issued August 9, 1898.

608,614. Plate for Secondary Galvanic Batteries and Composition for Producing Same. Carl Marschner, Berlin, Germany. Application filed September 30, 1896.

A plate for secondary batteries is composed of an exterior perforated containing frame of lead and a filling of an active material such as lead oxide and a binding medium composed of a solution of a fossil gum.

608,637. Supporting Clip for Overhead Electric Conductors. William A. Bartley, Boston, Mass. Application filed May 23, 1898.

Two interlocking members are provided respectively with fingers to engage opposite sides of the conductor, body portions being diagonally opposite the fingers, a sliding clamp adapted to be forced into engagement with the outer surfaces of the body portions, and means for retaining the clamp after it has been forced into operative position.



NO. 608,637.

608,676. Circular Loom. Josef Herold and Carl Herold, Brunn, Austria-Hungary. Application filed May 6, 1897. Patented in Austria January 2, 1897 and March 24, 1897; in Luxemburg March 4, 1897; in Belgium March 15, 1897; in England May 8, 1897; in France June 2, 1897; in Italy June 9, 1897; in Switzerland September 15, 1897; in Hungary October 5, 1897; in Canada November 22, 1897, and in Germany February 25, 1898, and March 1, 1898.

The electrical features of the apparatus comprise electro-magnets carried on an upright shaft, a stationary casing within which the magnets rotate, radial weft-beating levers adjacent to the lower end of the casing, magnetic shuttles bearing against the outside of the casing and resting on the levers, radial heddles above the levers, and annular cams rotating synchronously with the electro-magnets and engaging with the ends of the heddles.

608,685. Lightning Arrester. John F. Kelly, Pittsfield, Mass. Application filed December 16, 1895

A column of pieces of fusible metal partially oxidized and held in position in combination with suitable terminals in contact with the ends of the column respectively.

608,711. Electric Motor. William H. Powell, Erie, Pa. Application filed November 4, 1897.

A compound-wound electric motor has each of its poles divided into three or more parts, the end parts carrying shunt windings and the middle parts the series windings.

608,714. Storage Battery. John D. Rively, Pittsburg, Pa. Application filed June 9, 1897.

A storage battery is described consisting of a series of layers of fiber, oxide of lead, and plates of conducting material, the plates terminating in the positive and negative poles, and a series of perforated boxes between the layers, the boxes having perforated pipes extending through the same.

608,721. Automatic Electric Regulator. Robert Skeen, St. Louis, Mo. Application filed October 23, 1897.

An automatic electric regulator comprising a series of movable contacts, an electromagnet and armature therefor adapted to operate the contacts, electrical connections for the electromagnet and contacts, a movable piece normally in circuit with the contacts and adapted to be operated by the last of the series when the plunger is in its extreme position, and thereby open the circuit, and interposed insulation between the bar and last contact.

608,723. Electric Arc Lamp. Thomas Spencer, Philadelphia, Pa. Application filed September 29, 1897.

The method of operating an alternating-current arc lamp consisting in automatically reducing the inductance of the arc circuit when the lamp is starting into action.

608,768. Electro-dynamic Apparatus for Operating Clipping, Brushing or other Mechanisms. Warren P. Freeman, New York, N. Y. Application filed August 12, 1897.

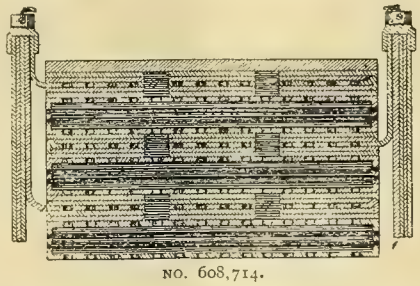
The field magnet of the portable electric motor forms a casing within which the operating parts are contained, and from which the rotary end of the shaft projects. Means are provided for attaching the stationary parts of the clipping mechanism to the stationary parts of the motor, the cutters of the mechanism sliding in guides upon the stationary parts, and a pitman being pivoted eccentrically at one end to the shaft and pivoted at the other to the cutters.

608,842. Electric Meter and Motor. Harry P. Davis, Pittsburg, and Frank Conrad, Wilkinsburg, Pa. Application filed June 18, 1898.

A meter for measuring the energy in alternating-current electric circuits comprising a core containing an air gap forming adjacent poles and having an intermediate pole, shunt-connected coils for oppositely magnetizing the adjacent poles, a series-connected coil or coils for magnetizing the intermediate pole, a movable closed conductor projecting between the pair of poles and the intermediate pole, means for retarding and means for registering or indicating the movement of the conductor and means for lagging the current traversing the shunt-connected coils.

608,846. Telegraph Repeater. Henry P. Donnelly, Cincinnati, Ohio. Application filed June 23, 1897.

This instrument comprises a relay having two opposing electromagnets included in different circuits, an armature located between the electromagnets and electrically connected with one of the circuits, and a movable contact device carried by the armature and permanently connected to the ground, the movable contact engaging the armature in one position so as to connect the armature to the ground directly, while in the other position of the armature the contact is electrically connected with the other circuit, and out of connection with the armature circuit.



NO. 608,714.

608,878. Switch for Varying Electrical Resistance. Eduard F. H. H. Lauckert, London, England. Application filed November 29, 1897. Patented in England May 2, 1895.

There are a series of conducting segments connected by successive resistances, and two or more brushes connected to move together but insulated from each other and electrically connected through a resistance, and designed to be moved over the conducting segments and in contact therewith, one or more of the brushes being of a width to lie over the interval between two segments and out of contact with either.

608,895. Generator for Electrical Igniters. Benjamin McInnerney, Omaha, Neb. Application filed March 30, 1898.

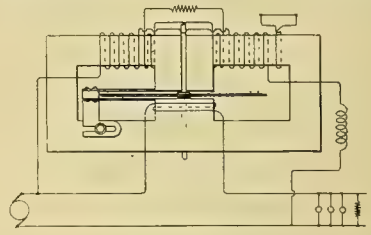
An electrical generator for electrical igniters for gas engines consisting of a permanent magnet and a wire-wound core arranged in proximity, an adjustable support therefor, means for adjusting the support during the operation of the engine and keepers attached to a moving part of the engine.

608,896. Generator for Electrical Igniters. Benjamin McInnerney, Omaha, Neb. Application filed March 30, 1898.

A generator for electrical igniters is composed of two parts, one carried by a moving part of the engine, the other relatively stationary, and means are provided for adjusting the relation of one part to the other during the operation of the engine.

608,906. Insulation of Electric Wires. Joseph A. Poché, New Orleans, La. Application filed June 22, 1898.

An insulation for conductors carrying currents of high potential consists of a surrounding insulating sleeve and two inclosing glass cones, retained by a collar at one end and a nut at the other.



NO. 608,842.

608,911. Electric Cable. Henry A. Reed, Newark, N. J. Application filed October 24, 1896.

In an electric cable, the combination is described with the conductor and the insulating covering therefor, of a sheathing or armor for the cable consisting of spirally laid wires of non-magnetic metal.

608,928. Apparatus for Heating Air for Therapeutic or other Purposes. William Taylor, Edinburgh, Scotland. Application filed December 21, 1897.

The portable apparatus described for producing a heated current of air or gas for therapeutic or other purposes comprises a casing, a directing tube mounted upon and carried by the casing, a tube of non-conducting material concentrically within the directing tube, an exposed resistance coil mounted upon the concentric tube and forming part of an electric circuit, and means within the casing for forcing a continuous current of air or gas through the directing and concentric tubes, whereby air or gas passing through the concentric tube and between the outer walls of the tube and the inner walls of the directing tube is heated.

608,932. Telegraphy. George V. Trott, Chicago, Ill. Application filed August 13, 1897.

This arrangement is applied to a system of railway telegraphy in which there is the combination with a trolley circuit of a telegraph instrument carried by a vehicle, trolley-contact mechanism carried by the vehicle, adapted to connect the telegraph instrument with the trolley circuit, a main telegraph line connecting or adapted to connect the telegraph instruments at a plurality of telegraph stations, and suitable switching apparatus and circuit connections adapted in one condition of use to complete circuit through the main telegraph line and to exclude the telegraph instrument upon the vehicle from circuit with the main telegraph line, and in another condition of use to connect the main telegraph line with its telegraph instruments in series with the trolley circuit and the instrument upon the vehicle connected with the trolley circuit.

608,952. Electrical Cooking Apparatus. John B. Cary, Baltimore, Md. Application filed March 14, 1898.

Two boxes contain the heating appliances connected by a hinge, one member of which is permanently secured to one box and the other member adjustably attached to the other box, and a shield is placed between the separated boxes to confine the heated air around the article being cooked.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, AUGUST 27, 1898. No. 9

Department of Electricity at the Trans-Mississippi and International Exposition.

When the plan of organization of the Trans-Mississippi and International Exposition at Omaha was developed it was determined to make the electrical features one of the principal attractions, and for this reason one of the most important buildings in the main group surrounding the Grand Court was assigned to electricity in conjunction with machinery and mechanical exhibits. The structure was accordingly designated Machinery and Electricity building. It occupies a commanding position at the end of the lagoon near the principal entrance from Sherman avenue, which is the main thoroughfare leading from the city to the grounds. It is particularly conspicuous at night in the view from the esplanade, which is the favorite point at which visitors congregate to witness the beautiful electrical effects that are presented in the illumination of the Grand Court. The picture on this page is a faithful representation of the building and the surroundings as they appear to the visitor to-day; in fact, it is a reproduction of the only photograph that has been taken since the building and ornamentation of the grounds have been completed. The main landing for the gondolas and swan-boats that carry visitors over the lagoon is directly in front of the Electricity building, and besides being a great convenience it adds to the attractiveness of the scene.

The building itself is an imposing structure and commands attention even in the group of strikingly beautiful edifices about the Grand Court. It has a frontage of 304 feet and is 144 feet deep. There are triple entrances on the main-floor level in the center of the main front and similar groups in the centers of the east and west fronts, with four emergency exists in the north wall. In front of the building, flanking both sides of the main entrance, is an open portico 16 feet wide, running the entire front of the building. Above the main floor is a gallery 32 feet in width, extending around the four outer walls. The gallery is reached by spacious staircases located at convenient points in the building. A high central court 248 feet long by 80 feet wide is lighted from the skylights and clere-story windows above the roof. The character of the exhibits sheltered by this building is clearly indicated by the decorations and by the names of the eminent scientists and inventors which are inscribed on the outer wall. The ornamental spandrels and panels receive all of their motifs and suggestions from machinery. The cresting at the top is composed of cogwheels, studded with incandescent lamps, which at night outline the building. The underlying principle and function of machinery is symbolized by the groups of statuary on the top of the building. At each corner is a group representing the early supremacy of man over the untamed forces of nature, which are pictured as wild animals. Men in their youth are seen subduing them for the simple purpose of escaping injury and the preservation of their own lives at the sacrifice of the natural forces. A higher supremacy is shown by the center group, which is the dominating feature of the entire design. In this, man, developed beyond the youthful stage, having wisdom, takes these untamed forces of nature, harnesses them to his chariot and makes them do his bidding, symbolizing in a direct way the service which machinery does for man in the application of steam, electricity and gravity. Color enters into the design only to accentuate the ornaments in the panels under the porticos and over the main entrances. The building presents a series of yellow and ivory tones, growing more intense as they reach the top, and culminating in the dull golden statuary which surmounts the building and symbolizes its use. The ornamental figures are clearly depicted in the illustration.

The organization and execution of the plans of the department of electricity were entrusted to Professor R. B. Owens, and he has faithfully discharged the duty imposed upon him. Every department of electrical industry is represented, and the exhibits displayed include the product of the leading institutions of the country. Telegraphy is represented by the Western Union Telegraph company, whose creditable exhibit was illustrated and described in this journal on August 13th. The telephone is likewise represented. The American Bell Telephone company has a handsome booth containing an historical collection, while the Nebraska Telephone company, which operates the exchange in Omaha, has a working exhibit, comprising a modern exchange switchboard of the latest Bell pattern. The Long-distance company (American Telephone and Telegraph company) is also represented. Two very creditable exhibits are made by representative independent telephone companies—the Western Telephone Construction company and the American Electric Telephone company—and those who are interested in this subject are afforded an excellent opportunity of studying the merits of the old and new companies. The exhibits of the independent companies were illustrated and described in this journal July 16th. Manufacturers of electrical machinery and supplies for the generation, distribution and application of electricity

FIG. 1. DEPARTMENT OF ELECTRICITY AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—MACHINERY AND ELECTRICITY BUILDING.

for light, heat and power are represented in the splendid exhibits of the General Electric and Westinghouse companies, which occupy conspicuous positions in the center of the building. The Western Electrical company of Omaha presents a fine line of supplies, well representing this important branch of the industry. The central-station development is graphically represented in the Chicago

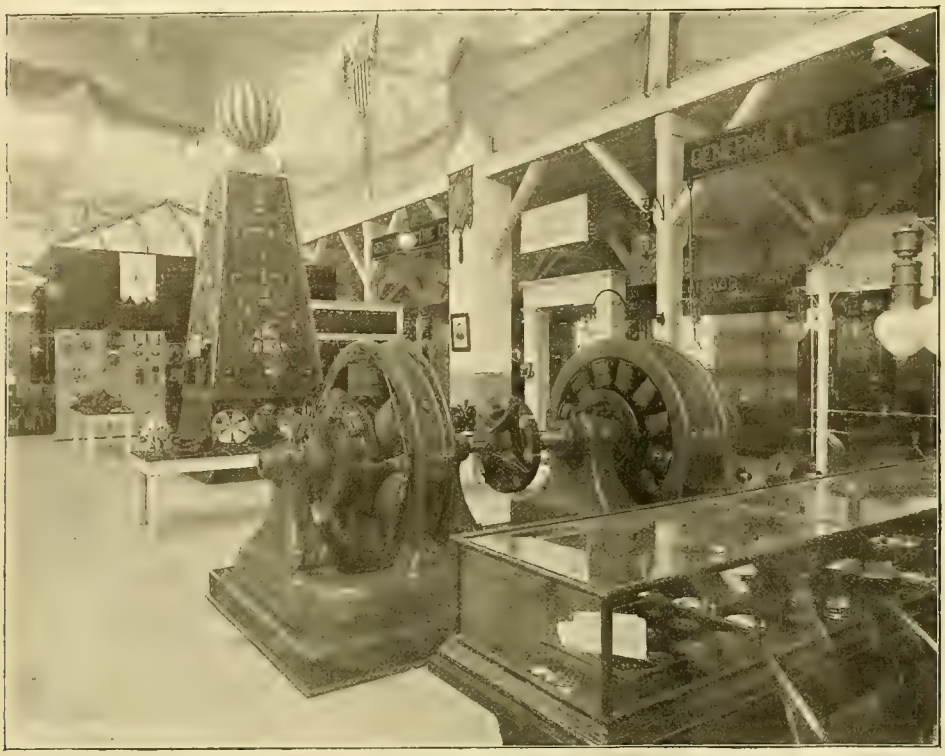


FIG. 2. DEPARTMENT OF ELECTRICITY AT THE TRANS-MISSISSIPPI AND INTERNATIO NAL EXPOSITION.—GENERAL ELECTRIC COMPANY'S EXHIBIT.

Edison company's booth, where the system employed by that company may be studied in all its details. Measuring instruments for central-station use and laboratory practice are shown in the booth of the Weston Electrical Instrument company. The personal exhibit of Bion J. Arnold is another attractive feature of the collection, and consists of some of Mr. Arnold's early boyhood work, as well as his recent engineering accomplishments.

GENERAL ELECTRIC COMPANY.

The most conspicuous feature of this company's exhibit at Omaha is the large pyramidal tower, surmounted by a sphere studded with incandescent lamps. Upon this tower are fixed all sorts of supplies, lamp sockets, cut-outs, devices used in overhead line construction, fittings for interior lighting, fan motors and station instruments and tools. An interesting example of transmission and distribution is furnished by the application of electricity in this exhibit. The current is taken from the equipment in the power house, passed through a large number of machines and finally consumed in the lamps, ventilating fans and power motors scattered about the exhibit. The power is taken in the form of direct current at 500 volts by a 110-kilowatt generator running as a motor and joined by means of a flexible coupling to a 150-kilowatt, three-phase, compound-wound, alternating-current generator, which delivers current at 1,000 volts, to be transformed down in three stationary transformers with both primaries and secondaries arranged in delta connection, from which it is delivered to a three-phase, four-pole, 60-cycle rotary converter. The motor-generator occupies a conspicuous position, and is clearly shown in Fig. 2. This, in turn, transforms it into direct current at 220 volts, which is used to charge a battery of chloride accumulators, arranged with end-cell switches for voltage regulation. Current is finally delivered to 110-volt lamps and utilized in other ways. A complete switchboard of modern design is fitted up with the latest instruments for central-station operation. A line of stationary transformers includes one having a capacity of 15 kilowatts. Open and enclosed arc lamps of standard types illuminate the exhibit. Induction motors, as large as 15-kilowatt capacity, show the application of the manually operated internal short-circuiting device in the revolving secondary for obtaining a good starting torque. New Thomson induction integrating wattmeters for alternating-current work and the new two-rate wattmeter with self-winding clock, for charging a higher rate at the time of day covering the peak of the load, command special attention. In the picture will be seen a showcase containing a full line of samples of miniature and decorative lamps, and tables on which are arranged a large number of fan motors, both direct and alternating, circuit breakers, motor starters, instruments, etc. The street-railway department contributes one G E 1,000 motor and one of the new G E 57 motors with the four internally projecting field poles and other improvements. The latter is equipped with a magnetically operated clutch brake and appropriate controlling apparatus. For the student there is presented in the line of historical apparatus the original Edison generator from the steamer Columbia, which, until very recently, has been giving continuous service from the time it was first operated in 1879. It is a matter of common remark that this machine closely resembles modern dynamos of the same type. This machine is to be sent to the Smithsonian Institution. Probably the most popular feature of the exhibit is that pertaining to Röntgen rays. An excellent

FIG. 3. DEPARTMENT OF ELECTRICITY AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION —WESTON ELECTRICAL INSTRUMENT COMPANY'S EXHIBIT.

equipment for showing the use of the apparatus now employed is included in this exhibit.

WESTON ELECTRICAL INSTRUMENT COMPANY.

Attention is at once attracted by the handsome booth of the Weston Electrical Instrument company, which occupies a conspicuous position near the eastern entrance to the Electricity building. An excellent view of this exhibit is presented in Fig. 3. The booth is pure white and the graceful columns present a striking appearance. On the walls are arranged the instruments designed for central-station work which have come to be accepted as standard for the trade, and in suitable cases laboratory and portable instruments. These include the station ammeter and voltmeter illuminated dial instruments, round pattern railway, isolated plant and feeder voltmeters and ammeters, potential indicators, portable direct-reading voltmeters and ammeters for alternating and direct-current circuits, portable ground detectors for direct-current, portable voltmeters and wattmeters for alternating and direct currents, portable galvanometer for direct current and an arc-light ammeter.

One of the most interesting features of the collection is the ammeter for laboratory purposes. This is a semi-portable ammeter, based on the Vienna method of measurement. The apparatus consists essentially of German silver strips, immersed in a copper box full of paraffine oil. The resistance of these German silver strips may be quite low and yet the fall of potential in them, when carrying a current, may be measured with extreme accuracy and rapidity. The voltmeter may be wound with the same metal that is used in the resistance, so as to avoid variations due to temperature. By inserting in the box German silver strips of different carrying capacities, and adjusting separate coils in a Weston standard portable voltmeter, a direct-reading ammeter of wide range and accuracy is obtained, which for laboratory purposes has no superior. This instrument has in addition the advantage, assuming the standard resistance to remain constant, that its indications may be checked by a standard cell. Special claims are also made for the portable direct-reading voltmeters in connection with storage batteries. The increasing use of batteries has, of course, made this subject of particular importance. The type of instrument mentioned is particularly useful in battery work, as by its means not only can the aggregate potential of a series of cells be determined with great accuracy, but the electromotive force of a single cell may be read off, with ease, to the nearest hundredth of a volt.

Many special instruments and special applications of standard instruments are shown. This exhibit forms one of the most attractive features of the electrical section.

COMMUNICATION.

Generating Plant Wanted.

To the Editor of the Western Electrician:

We have under consideration the establishing of a plant for making our own power and lights. We are using at present seven motors, aggregating about 80 to 85 horse power, while our light account is quite considerable. We presume there are companies who make a specialty of bidding on putting in plants of this character, and we presume that you will be glad to publish this in your paper for the benefit of your subscribers who do this work. LUDLOW-SAYLOR WIRE CO.

St. Louis (Fourth and Elm streets), August 20, 1898.

Modern Roundhouse Turntable.

The economics of railroad management do not end with the adoption of the high-pressure compound locomotive, or the many other contrivances which have been born of necessity, but go on and on, always finding a way to eliminate here or there an unnecessary expenditure.

A late economic development is the particular adaptation of the electric motor to turntables called the Westinghouse turntable "donkey." The simplicity of the device and the method of operating it are plainly evidenced in the group of illustrations.

The device is the product of the Westinghouse Electric and Manufacturing company, and consists of its "series reversible" type "F" 10 horse power motor, mounted within a heavy cast-iron frame, having a traction wheel which rests upon the rail of the turntable pit. Power is transmitted to this wheel through double reduction gears. The "donkey" frame is connected by draw bar and pin to one end of the turntable at the side, sufficient traction for the driving wheel being secured through the weight of the machine, which is 3,700 pounds. Wires are run from the "donkey" to a small platform located at one side of the center of the turntable or other convenient place, at which point is installed a controlling rheostat. By means of this controller the "donkey" may be operated in either direction and its speed controlled at will by simply moving a single lever to one or the other side of a neutral point. Current, which may be supplied from the shop lighting or other convenient circuits and may be either alternating or direct and of any standard voltage, is supplied by wires brought to a suitable contact overhead and then led to the controller.

As no changes in the turntable are required for installing the turntable "donkey," the connections between frame of the latter and the turntable girder being very simple, the cost of installation is low. As compared with the steam-operated turntable it is apparent that electrical power has the advantage, as it is a well-recognized fact that the small portable boiler and engine are extremely wasteful of fuel, besides being a source of danger and requiring constant expert attention.

The comparison with turntables operated by push-poles is no less interesting. In one of the installations, located at an important division point, it was necessary to turn 176 engines each 24 hours, or about seven per hour. Previous to installing this "donkey," push-poles were used, requiring the services of four men, and the operation was a slow one at best. Now one man does the work in a much shorter time. With turntable "light," the "donkey" will make a complete revolution in 30 seconds, while with a 10-wheel locomotive on the table, weighing, with tender, 100 tons, a complete revolution is made in 45 seconds. We therefore have the following summary:

Engines turned per day	176	
Men required	4	
Average time, each man	5	min.
Total time per engine (5 minutes by 4 men)	20	"
Total time for 176 engines	59	hrs.
Total time for 176 engines, with electric donkey	24	"
Time saved	35	"
35 hours at 12½ cents, amount saved per day		$4.37

The above calculations assume that the men are employed in wiping engines while not employed in operating turntable; otherwise the comparison would be still more favorable to electrical operation.

The assumption of five minutes per man on the average is conservative. It is plain that the 35 hours saved would supply two day and two night men as wipers on shifts of eight hours each.

It is stated that actual tests have shown that the power consumed by the electric "donkey" is the equivalent of one-half horse power per hour. Assuming six pounds of coal per horse power, with coal at $2 per ton, the cost of turning each locomotive would be three-tenths cent, or 53 cents for 176 locomotives.

The Annoying Sparrows of Kansas City.

This is the story of the unfortunate error of the sparrows of Kansas City, as related in the sprightly fashion by the Star of that place:

"It's the birds," exclaimed the unhappy electrician to the superintendent.

For the fiftieth time a department of the great Swift packing-house had been plunged into darkness by the failure of the electric lights, and for the tenth time the superintendent had called the electrician, Mr. Kobell, to time.

"Birds—bosh!" retorted the superintendent.

"It's a fact!" protested the electrician. "The confounded birds take the safety strips between the binding posts for threads and try to grab them off for their nests. Every time they pounce on a wire they break the current."

"Bosh!" repeated the superintendent.

The electrician rushed out and returned with two limp sparrows.

"Look at the blisters on this one's feet," he cried, "and this one's bill is melted off."

Sure enough, the sparrows were burned and blistered.

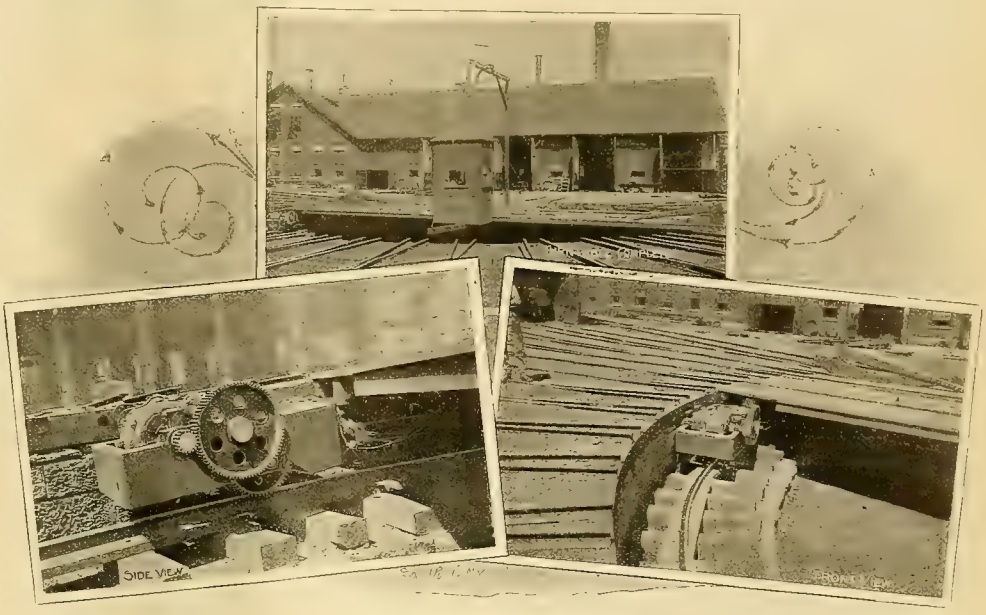
Under the eaves of the building the thin lead safety wires, resembling threads, had proved a charnel place of birds. These wires are inserted to burn out in case of a short-circuit or grounded wire.

Now they are covered with mica to keep off the birds.

General Distribution from Central Stations.

PART II

Mr. Pillsbury, St. Louis: I wish to say a few words in regard to the alternating-current motor, having been identified for several years with the development, more especially, of single-phase machines. The question has been raised as to their power factor by one gentleman, as to their practical success by another, and as to their adaptability for the direct driving of elevators by several others. Single-phase alternating-current motors are now made equal, if not superior, to direct-current motors for general power distribution. The power factor in a well-designed machine may be considerably above 90 per cent.—from 50 to 150 per cent.—of its rated capacity, and above 80 per cent. while the motor is developing 20 per cent. of its rated output. For general power distribution they are superior to direct-current motors in point of care and attendance required, average efficiency, absence of wear, etc. To the direct driving of elevators they have not as yet been applied, but there is no reason why they cannot be adapted to this work as soon as a sufficient demand shall exist. The only problem met with in their application to this class of service is that of starting. There are two methods of doing this, one by splitting the phase and another by introducing a commutator. Either of these is entirely successful. The latter is the more efficient and for general power distribution is to be preferred where an excessive starting current is objectionable, because of its likelihood to produce a fluctuation in the pressure at seven and one o'clock when many motors are being started at once. It is not well adapted for elevator work, however, because sparking cannot be altogether eliminated from an alternating-current commutator. While this spark is not objectionable where the machine is started only occasionally, it would be in the case of an elevator starting many times a day. The other method as at present developed gives ample torque, but at a comparatively low efficiency, and by the use of a large current. The efficiency of a direct-current motor, however, is also low in starting, and at times the current consumed is excessive. I apprehend, however, that inasmuch as all the elevators do not start at once, this is a matter of comparatively small importance to the central station. It may be confidently affirmed that single-phase alternating-current motors are now on the market that are superior to direct machines for general power distribution, and that in the near future they will be adapted to such special work as the direct driving of elevators with entire success.



MODERN ROUNDHOUSE TURNTABLE.

Mr. Insull, Chicago: The Chicago Edison company is in no sense wedded to any particular system. Within the last week I have shut down a three-wire Edison system. I would like within the next week to shut down an alternating system. With us it is simply a question of the most money we can possibly make out of a given investment. I think if you will study Mr. Ferguson's paper you will find that he has gone into this question not merely in a theoretical way, but that his observations are based upon the actual results obtained in a year's operation of a large property. This property has been in existence some 10 years. If you study Mr. Wagner's paper you will find that he presents to you for use in large cities principally—as his paper is based upon operations in a large city—a new scheme that has not stood the test of time, and that cannot be set up in comparison with the low-tension system until a company under Mr. Wagner's plan has developed the business to a point where you can make a comparison of investment with investment, expenses with expenses and return with return. I know that most of the [illegible] are alternating men, and that you had spoken a low tension man, but I would [illegible] exactly what Mr. Wagner has stated this morning with relation to the advantage of an alternating distributing system as against the present three-wire system was stated, for different reasons, of course, with relation to the alternating house-to-house system that you are now using, as against the three-wire system, 10 or 12 years ago. Now what has been the result of experience? The manufacturer used to tell us 10 years ago that alternating-current generation with house-to-house converter distribution meant a very much lower investment cost to the men providing the money. Exactly the contrary has been proved to be the case in large centers of population, where there is much business. It has also been proved that in the smaller centers the losses are so great that some such scheme as Mr. Wagner proposes is absolutely necessary if you are going to sell electricity in competition with other forms of artificial illumination. I do not know that I am competent, in fact, I do not care, to go into the slight differences that are shown by Mr. Wagner's inferences on one hand and Mr. Ferguson's absolute figures on the other hand, and the slight difference of economy which Mr. Wagner claims. What I would like to know from Mr. Wagner is, whether he has a statement of his generated output for a year, and his delivered output for a year, and what is the difference between the two, and how closely they compare with the percentages as stated in his paper. I would like to know at the same time how he has obtained a record of his generated output. The Chicago Edison company cannot swear to any absolutely correct output at the present time, and the differences of efficiency claimed by Mr. Wagner might possibly disappear in the personal errors that might enter into the calculations.

I assisted in laying the first conductors for a multiple-arc central-station system in New York, and the only change that has ever been made in the distribution system is the change from the two-wire to the three-wire system. If the Chicago Edison company could profit by the adoption of Mr. Wagner's scheme (and I doubt whether Mr. Wagner would claim that), the only changes we would have to make would be in our feeder system, and those changes would depend on whether our insulation would stand the high voltage. Our distribution is a permanency; it has not changed from year to year to my certain knowledge since about 1884. We have not been trying first one translating device, then a new system of distribution, and then another translating device, all of which pile up big interest cost. We have been working on the same lines. I would like to ask Mr. Wagner if the city of St. Louis, in which he has done such remarkably good work with the alternating current, had started first of all in the central portion of the city with an Edison three-wire system, whether he would have any reason to change it to-day?

I think a little retrospective view of the industry might be advisable before looking into the future. Those who are running large companies, who have made a handsome return on the investment from the very first, and who started originally on a scheme of distribution which has not varied since the introduction of the three-wire system, I think might find that it would be better to continue that course wherever they can, rather than to adopt something which is radically new and untried, except for a comparatively short time. With the exception of two or three companies represented in this room the Chicago Edison company sells more alternating current than anyone here. The systems we have are on a house-to-house plan, which, as you know, is

not satisfactory. The losses are enormous and the difficulties of handling the proposition for the future are at the moment apparently insurmountable. They bear evidence of the fact that the engineering was of the poorest character and that the system as a whole was never properly worked out. I do not know to whom Mr. Wagner refers when he says "The standpoints in general mark the difference between the manufacturer and the user, and we find these two systems developed in this way, one almost entirely by the manufacturer, and the other by the combined efforts of the various users." I know that some systems bear evidence that they were developed by the manufacturers for the purpose of selling large amounts of apparatus; as to which system was developed by the users I am in doubt. Probably Mr. Wagner can explain it.

Mr. Wagner made some facetious remarks about these "beams of copper." Those beams of copper earn a return for my stockholders. As to whether you shall have beams of a certain size is simply a question of interest cost, fuel cost and other incidental costs under varying conditions. With fuel very low an Edison man would naturally decrease the size of his beams. With fuel very high he would increase it. It is a question of balancing the interest cost against the other portions of the cost, and the size is simply an incident in the matter.

Mr. Wagner also referred to the use of storage battries. I may say that I agree with him to some extent. He says in his paper that you may ask as to whether storage batteries have been proved to be a valuable adjunct to the central stations, cost and maintenance considered. I would ask him whether his proposed system of alternating distribution has yet been proved to be a more valuable adjunct to the central station as compared with the three-wire low-tension system? So far as the Chicago Edison company is concerned its storage battery only went into use yesterday, so we are not in a position to say much about it. It is to some extent an experiment. It is true that it is an expensive one, but still it is an experiment. Recently one of the electrical journals quoted me as having changed over from an opponent to an advocate of storage batteries. They were a little previous in making that statement; but I can say this, that one of the primary reasons in deciding to use a storage battery was the difference in the investment costs between the battery and the construction of a trunk line that would have had to take its place. That is an important factor, as I said before. Interest cost comes in in all these matters. It is a question of conditions.

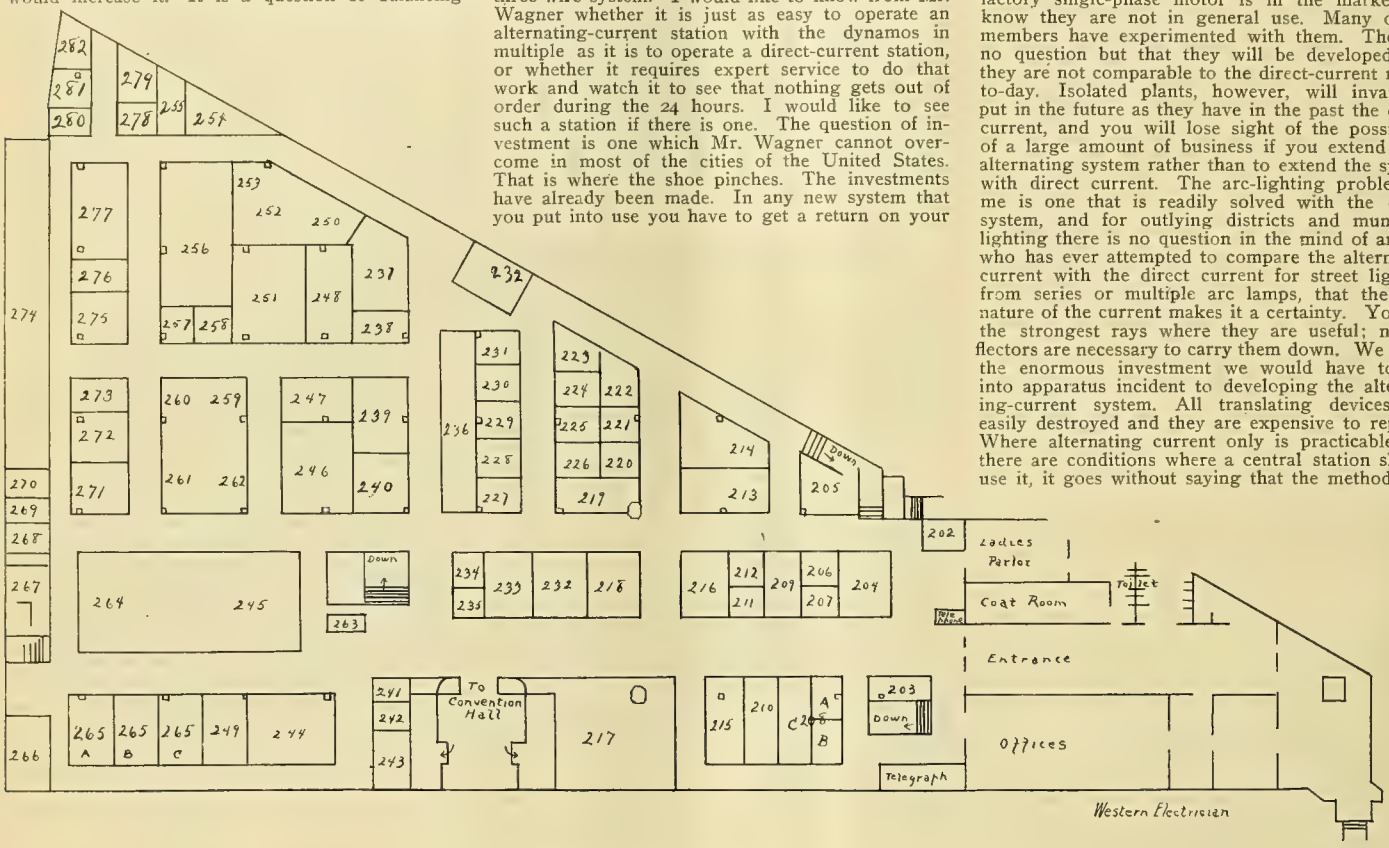
Now as to Mr. Wagner's closing claims. The first is "highest possible efficiency of distribution and operation." I judge from that that Mr. Wagner means the cost of distribution and operation will be lower in the alternating-current system than in the case of a three-wire system. That has yet to be proven. It has not been proven so far anywhere in the world, and it afforded me great pleasure in listening to Professor Fujioka to learn that the new civilization of the far East has about the same engineering ideas as one of the most advanced cities in the civilization of the West, if you will excuse the comparison.

The next claim is "best regulation." You cannot have anything except perfect regulation. Our charts are at your disposal, gentlemen. I think we have them for several years back, and I am prepared to stand on the matter of regulation by the record shown by our business and the record shown in connection with Mr. Wagner's scheme.

The next claim is "largest territory desired readily supplied from one station." There comes the question of investment. It is simply a question of conditions. The greatest claim is flexibility. If you can find anything more flexible than a system operated during the whole of the 24 hours, first from one station, then from two, and then from three, at the same time during the 24 hours carrying current 13,000 feet from the point of generation with a loss almost impossible to figure out, we will be delighted to adopt it.

Another claim is "the only system in which all classes of service can be supplied from one type of generator." I take issue and challenge him to show a plant in operation where that condition exists, except in the case of the low-tension direct three-wire system. I would like to know from Mr. Wagner whether it is just as easy to operate an alternating-current station with the dynamos in multiple as it is to operate a direct-current station, or whether it requires expert service to do that work and watch it to see that nothing gets out of order during the 24 hours. I would like to see such a station if there is one. The question of investment is one which Mr. Wagner cannot overcome in most of the cities of the United States. That is where the shoe pinches. The investments have already been made. In any new system that you put into use you have to get a return on your existing investment and a return on your new investment, and provide enough money to wipe out in the shape of depreciation either the old investment or the new investment. You have to get that money from your customers, and, of course, that carries us back again to the early mistakes. I think it was Mr. Bowker, the vice-president of the Edison Illuminating company of New York, who, when we first started to discuss this question of the use of alternating current in connection with the low-tension Edison station, pointed out the absolute permanency of the main investment in low-tension work, that is the distribution system; and although Mr. Wagner may be correct in the claims he makes as to percentages of efficiency—on that subject I am not competent to offer an opinion—I would warn you to go very carefully, especially in the large cities, about adopting a scheme over one that has received the test of time. So far as widely distributed areas are concerned there is no doubt that the alternating current is of great advantage to us, but in big centers of distribution I think that the experience of electrical engineers the world over has shown that the one system to use, the one which can make money and which will enable us to keep our positions, is the low-tension Edison system.

Mr. Ayer, Boston: The discussion resulting from papers like these largely relates to the practice in large cities. The membership in the association, however, is not made up of representatives of large cities entirely, and it seems to me there is ample food in these two papers to give us some lessons that will apply to all. One thing that I think is pretty generally understood by the operators of central stations in the last few years is the necessity of getting rid of the house-to-house transformer, which means going to the three-wire distribution. We are all working toward that end. It seems to me from this discussion that it is the right thing; in other words, that method of distribution is the best, it produces permanency of investment and leads up to a settled method for one detail of our plan. The motor business is coming to be quite a factor, as you appreciate. The alternating-current motor, while not developed to its highest efficiency, and not so well known, may have great possibilities; but it is not going to exceed the possibilities of the direct-current motor. The question of the flexibility of the current, while it is not so much a question to-day as it was five or 10 years ago, is still very important. There are special uses and demands, but in regard to the relative value of these investments we know that you have to make some experimental investments to-day in alternating-current motor; you have the question of insulation to contend with, and in all high-tension devices as you get up in pressure you decrease the life of the devices and the investment is of a less permanent nature. The character of the services that you could get from one or the other is varied. It is easier to regulate the low-pressure system than the high, but the real question is to get the thing which will bring you the greatest amount of business at all times. The low-tension system certainly does that. While we have the statements that a perfectly satisfactory single-phase motor is in the market, we know they are not in general use. Many of the members have experimented with them. There is no question but that they will be developed, but they are not comparable to the direct-current motor to-day. Isolated plants, however, will invariably put in the future as they have in the past the direct current, and you will lose sight of the possibility of a large amount of business if you extend your alternating system rather than to extend the system with direct current. The arc-lighting problem to me is one that is readily solved with the direct system, and for outlying districts and municipal lighting there is no question in the mind of anyone who has ever attempted to compare the alternating current with the direct current for street lighting from series or multiple arc lamps, that the very nature of the current makes it a certainty. You get the strongest rays where they are useful; no reflectors are necessary to carry them down. We know the enormous investment we would have to put into apparatus incident to developing the alternating-current system. All translating devices are easily destroyed and they are expensive to replace. Where alternating current only is practicable and there are conditions where a central station should use it, it goes without saying that the method outlined, or substantially that, is one which should be taken up wherever the conditions warrant it; but I want to express my conviction very firmly that the old system is the best one.



AMERICAN STREET RAILWAY ASSOCIATION.—MAIN FLOOR OF EXHIBITION HALL.

Mr. Fakes, Oklahoma City, O. T.: Our station is operated all night with 42 arc lights, 2,000 candle power, Western Electric type, running all night, and our incandescent plant runs all night. We have found that our coal consumption is very light from 12 o'clock until the morning. We have 79 arc lights which run until midnight, and then we run the 42 city lights. We use two tons of coal for an average run of 11½ hours on our arc circuit for the city and 13½ hours on our incandescent circuit. We run from midnight until morning on three-quarters of a ton of coal. We have no station meter to tell us, but we know we are operating at a very low cost so far as our fuel consumption is concerned.

Mr. Davis, Williamsport, Pa.: We use the Westinghouse system and make some money. We have favorable conditions, in that we have a good day load. I desire to get the experience of any station that is using now or installing alternating enclosed arc lamps in competition with the Edison system, and would like to know particularly whether it can get as much per kilowatt-hour for current as the Edison company.

Mr. Stetson, New Bedford, Mass.: I will not answer that particular question, because we are not furnishing that particular kind of light; but I represent a company which has both forms of current. We are running the Edison system and the alternating system, and I am sure that I do not know which one we want to spare. We want them both. I think it is a very good combination. We extend our light into a neighboring community, running four or five miles. We certainly could not do that on the Edison system, and whether it is a matter of the great economy or the difference in

economy, it is the fact of getting your money after you have a station established. The cost of a few more lights is generally the cost of the coal; that is, your interest and labor is a fixed amount, and if you can add outlying districts by any system it seems to me it is a good idea to be able to use that system. We find that it helps us in our income to take on this load of a neighboring city that would be entirely out of our reach with any other than the alternating system, on account of the small service required and the prohibitory factor of supplying that amount with an expensive output of copper. I was pleased by the remark of President Insull this morning when he recommended that the alternating interests should establish themselves in some large community and prove their statements. If he will mention any large community like New York, Chicago or Boston, where the Edison company has not already obtained all there is in it, I presume the other people will be glad to go there and put up a plant.

Mr. Van Trump: Mr. Ferguson speaks of the maximum pressure being 149 volts, and the average pressure of all stations 126.2. From that he figures that his average efficiency of distribution is 91.2. It seems to me with the 149 volts as a maximum pressure that the watts loss at the time of maximum load would form a very much larger proportion of the loss on an Edison station than the mean volts would indicate. I think the watts lost would be much larger than 8.8 per cent.

Mr. Ferguson: The efficiency of distribution is arrived at by taking the ratio between the pressure delivered at the customer's meter and the average station pressure for the year, which is 115, divided by 126.2 volts. The maximum station pressure at the time of maximum load has nothing to do with the case. That is 149 volts and is maintained for a short period of time. The true calculation is obtained by considering the average station pressure of 126.2 volts, as I have given it, which is obtained by dividing the total yearly watt-hours by the average amperes for the year.

Mr. De Camp, Philadelphia: What is the natural drop in the lines under normal condition?

Mr. Ferguson: The average drop is 11.2 volts, or 8.8 per cent.

Mr. De Camp: What drop did you have between your switchboard and terminal?

Mr. Ferguson: The original distribution had a maximum drop of 10 per cent. The average drop was about 3 1-3 per cent. The maximum drop from the center of the distribution to the feeder ends is now 10 per cent., and the average drop is 2.7 per cent. for the year, showing an efficiency of distribution of 97.3 per cent. That would correspond to the average Edison central station, where the station is located in the center of the business district.

Mr. Insull: I think a short explanation as to our conditions will make this matter plainer. We had a station in the center of the city in Adams street, where our center of distribution now is. We moved 3,400 feet from there so as to have the river on one side of the station and the railway tracks on the other side, to enable us to get free water for condensing and to get coal at the minimum price. The cost between the two stations is about one-quarter more than is used to be. It is simply a question of balancing fuel cost against interest cost and labor. The reason of the excessive drop here is because of the peculiar local conditions. We can buy coal very cheap and we do not have to cart it if we are on the railway track. On the other side of us we get Chicago river water for condensing and feed-water purposes for nothing, just the pumping, so that our excessive drop is a question of spending money that way in order to save another way.

Mr. Hubeley, Louisville: Our station has about 2,000-kilowatt capacity on the alternating system. It seems to me that the main question is one of converter loses—iron losses. We find we have about 50 per cent. losses. Three years ago the losses were 70 per cent. We have made an improvement by adopting better converters of larger sizes. We have had converters that would pass the specifications as being very good converters, and within six months their losses would increase from 200 to 300 per cent., which would make them more profitable in the scrap pile than in service. We consider a converter that will run anything under eight per cent. on a 10-light machine, 500 watts, to 1½ per cent. on a 500-light machine with 2,500 watts, as being a good converter. We find in practice that the losses will run as high as 20 per cent. Converters in service which under actual test had four per cent. iron losses, after a year and a half of service had 13 per cent. In another case, a 20-light converter which had six per cent. iron losses at the beginning had 16 per cent. at the end of two years. The all-important question with the alternating station is the fact that as yet they have not been able to manufacture converters without these losses. I would like to hear the experience of other members who have investigated this question.

The police board of Buffalo is putting in a telephone exchange for its own use, including 155 transmitters furnished by the Pennsylvania Electric company, and 155 receivers, 12 adjustable desk sets and 13 desks sets for the station house, furnished by the Wilhelm Telephone company of Buffalo.

American Street Railway Association.

The local committee having in charge the arrangements for the Boston meeting of the American Street Railway association next month has completed the work of dividing the exhibition hall and allotting the space to applicants. The floor plan of the basement is shown in Fig. 1 and that of the main floor in Fig. 2. Trucks and cars and moving machinery will be placed in the basement, and facilities given exhibitors to demonstrate the special features of their apparatus. The main entrance to the convention and exhibition building will be closed up and visitors will enter at the end of the building. This plan is in keeping with the policy of the association to give the supply men every possible opportunity to display their goods. It will be necessary for members in proceeding to the convention hall, which is located on the upper floor, to pass through the main body of the exhibition building. It will be noticed from the diagrams that plenty of space has been devoted to aisles, so that there will be no crowding, as has been the case in many former exhibitions. The exhibitors and the space allotted them are given in the list appended, and by referring to the corresponding numbers on the diagram the relative location of each exhibitor will be seen:

BASEMENT.

Space.	Address.	Square feet.
101	.....	420
102	McCardell & Co., Trenton, N. J.	220
103	Rochester Car Wheel Works	600
104	New York Car Wheel Works, Buffalo, N. Y	400
105	Taunton Locomotive Manufacturing company, Taunton, Mass.	1,450

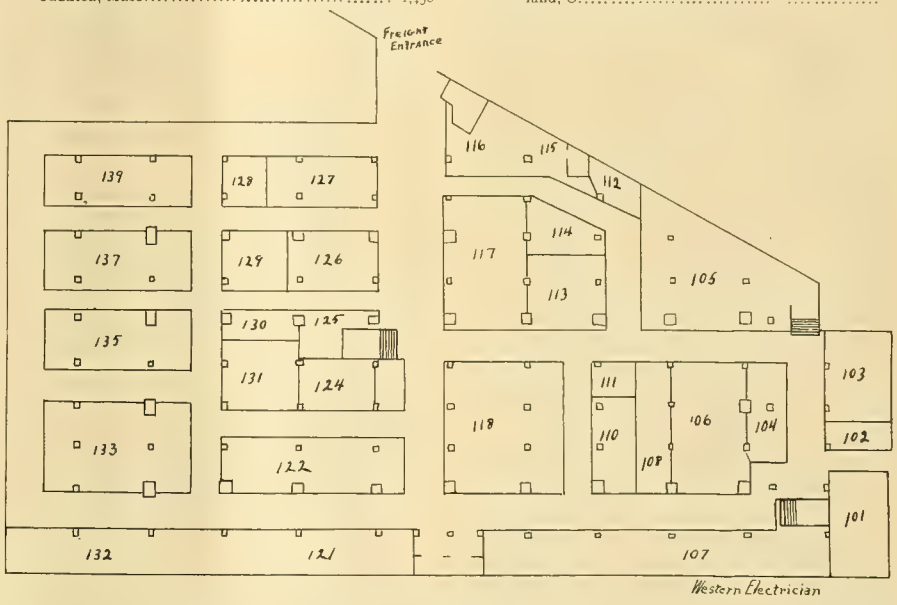


FIG. 1. AMERICAN STREET RAILWAY ASSOCIATION — ALLOTMENT OF SPACE FOR HEAVY MACHINERY IN BASEMENT.

106	Laconia Car company, Boston, Mass	819
107	Peckham Truck company, New York	1,500
108	Barney & Smith Car company, Dayton, Ohio	429
110	Briggs Carriage company, Amesbury, Mass	360
111	James L. Kimball, Boston	108
112	Graham Equipment company, Boston	100
113	Wells & French company, Chicago	414
114	.....	346
115	.....	550
116	.....	550
117	McGuire Manufacturing company, Chicago	920
118	J. G. Brill company, Philadelphia, Pa	1,248
121	Walker company, Cleveland, Ohio	1,450
122	Taylor Electric Truck company, Troy, N. Y	853
124	Pennsylvania Car Wheel company, Pittsburg, Pa	420
125	.....	
126	Hampden Corundum Wheel company, Brightwood, Mass.	416
127	Springfield Manufacturing company, Bridgeport, Conn.	300
128	.....	210
129	.....	320
130	.....	198
131	Baltimore Car Wheel company, Fulton Junction, Baltimore, Md	440
132	Walker company, Cleveland, Ohio. (See 121.)	
133	Johnson company, Lorain, Ohio	672
134		
135	.....	
136	.....	
137	.....	660
138	.....	
139	.....	630

MAIN FLOOR.

Space.	Address.	Square feet.
201	.....	
202	.....	100
203	Samson Cordage Works, Boston	100
204	Ohio Brass company, Mansfield, O.	300
205	New Haven Car Register company, New Haven	250
206	Corning Brake Shoe company, New York	100
207	Ashton Valve company, Boston, Mass	100
208 A	Ham Sand Box company, Troy, N. Y	100
B	Wadsworth Howland & Co., Boston, Mass	100
C	American Mason Safety Tread company, Boston	100
D	C. W. Trainer Manufacturing company, Boston	100
209	Creaghead Engineering company, Cincinnati, O	200
210 A	A. O. Norton, Boston	100
B	Forsyth Brothers company, Chicago, Ill.	100
211	American Railway Supply company, New York	100
212	Adam Cook's Sons, New York	100
213	Pantasote company, New York	264
214	Thayer & Co., Inc., Boston Mass	350
215	Albert & J. M. Anderson Manufacturing company, South Boston, Mass.	240
216	H. W. Johns Manufacturing company, New, York.	300
217	Westinghouse Electric and Manufacturing company, Pittsburg	1,921
218	Bureau of Information, Boston, Mass	280
219	Harold P. Brown, New York	200
220	F. H. Newcomb, Brooklyn, N. Y	100
221	W. P. Van Dern company, Chicago, Ill	100
222	Falk Manufacturing company, Milwaukee, Wis	100
223	Frederick C. McLewis, New York	110
224	Beverly Machine Works, Beverly, Mass	160
225	Boardman Tucker company, Boston, Mass	160
226	Stanley & Miles, Whitman, Mass	100
227	J. T. McRoy, Chicago, Ill.	100
228	Standard Underground Cable company, New York	100
229	Pierson Jack company, Boston, Mass	100
230	Wagner Electric Manufacturing company, St. Louis	100
231 A	E. F. Dewitte & Co., Lansingburg, N. Y	100
B	.....	100
232	Street Railway Review, Chicago, Ill.	300
233	Street Railway Journal, New York, N. Y	300
234	Railway World, London, Eng	120
235	Electrical Review Publishing company, New York	120
236	Ornamite Veneer company, New York	100
237	Pennsylvania Steel company, Boston, Mass	100
238	Weber Railway Joint Manufacturing company, New York	120
239	The Adams & Westlake company, Chicago	100
240	Bibber White company, Boston, Mass	112
241	C. F. Orr & Co, Chicago, Ill.	100
242	.....	100
243	William P. Ellis, Boston, Mass	200
244	Pettingell, Andrews & Co., Boston, Mass	402
245	General Electric company, Schenectady	1,653
246	The Consolidated Car Fender company, Providence, R. I.	197
247	Christensen Engineering company, Milwaukee, Wis.	264
248	Barbour-Stockwell company, Cambridgeport, Mass.	118
249	Billings & Spencer company, Hartford, Conn.	200
250	Sherburne & Co., Boston, Mass	530
251	William Wharton, Jr., & Co., Philadelphia, Pa	503
252	See 250.	
253	See 250.	
254	.....	175
255	.....	125
256	The Cleveland Frog and Crossing company, Cleveland, O.	800
257	Cambria Iron company, New York	100
258	American Rail Joint Manufacturing company, Cleveland, O.	100
259	Van Wagoner & Williams Hardware company, Cleveland, O.	874
260	International Register company, Chicago, Ill.	
261	Frank Ridion company, Boston, Mass.	
262	R. D. Nuttall company, Allegheny, Pa	
263	John Stephenson company, New York	100
264	General Electric company. (See 245.)	
265 A	Consolidated Car Heating company, Albany, N. Y.	200
265B	Heyward Bros. & Wakefield company, Boston, Mass.	200
C	Boston Artificial Leather company, Boston, Mass.	200
266	Burdett & Johnson, Boston	180
267	.....(With 24-foot counter)	128
268	Crosby Steam Gage and Valve company, Boston, Mass.	100
269	R. Woodman Manufacturing and Supply company, Boston, Mass	100
270	The Columbia Machine Works, Brooklyn, N. Y.	100
271	Charles Scott Spring company, Philadelphia, Pa	210
272	Pratt & Letchworth company, Buffalo, N. Y.	210
273	E. T. Barrows company, Portland, Me	150
274	Elmer Morris, New York, N. Y.	1,080
275	Meaker Manufacturing company, North Chicago, Ill.	200
276	.....	150
277	Sterling Supply and Manufacturing company, New York	400
278	William Tauss Rail Joint, Chicago, Ill.	100
279	.....	100
280	John F. Obmer, Dayton, O.	100
281	J. A. Lakin & Co., Westfield, Mass	150
282	.....	

As already announced, Secretary Penington has completed the programme, and it is now in the hands of the printer. The design is artistic and appropriate. A picture of Bunker Hill monument graces the title page and the American flag in colors adorns the cover. The arrangement of the programme is convenient and attractive. Special attention is directed to the exhibits, and the members are requested to show their appreciation of the time, thought and money expended by the supply men in making a creditable and attractive display.

The ladies' committee, composed of wives of the street-railway men of Boston, who will entertain the visiting ladies, has been completed. It is composed of Mesdames John Graham, E. C. Foster, A. A. Glasier, E. P. Shaw, J. H. Goodspeed, R. A. Goff, W. W. Sargent, A. B. Bruce, C. H. Barnes, B. J. Weeks and C. H. Wilson.

A telephone line is about to be constructed between Truro, Ia., and St. Charles.

Western Electrician.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CIRCULATION, 20,000.

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We notice—and it is an interesting fact—that some of our English technical contemporaries are zealous exponents of everything English with the one exception of English grammar. As the late Mr. A. Ward would say, Why is this thus?

Boston is entertaining eminent scientists this week, and the good people of that city are exceedingly happy over the honor conferred upon them. Next month the American Street Railway association will invade the sacred precincts of the Hub and exchange views upon purely commercial matters with the local capitalists who are interested in electric railways. Following this will be the annual industrial exhibition in Mechanics' Institute. Who says Boston is not up-to-date?

The Paris exposition, like all modern exhibitions, will devote considerable attention to electrical apparatus. The classification of exhibits of this kind is reproduced in another column this week, from the official announcement of the commissioner-general of the United States. American electrical manufacturers will be particularly interested in this exposition, as it will give them an excellent opportunity to place their wares in comparison with those of other countries with which they hope to compete. Industrial expansion cannot fail to prove beneficial to American electrical interests.

A man who manages an open-air place of entertainment on the West Side has made a complaint to the commissioner of public works of Chicago to the effect that the fees for the city inspection of his electrical plant amount to $200, and that the sum is excessive. The regular schedule of charges includes items of 10 cents for each connected incandescent lamp inspected, one dollar for each arc lamp and one dollar for each horse power of electrical machinery. These fees are for the initial inspection; for each re-inspection one-half of the first fee is charged. It is reported that the commissioner, in placating the complainant, said that the ordinance was passed when there were not so many electric lights as at present. To be entirely candid, he might have added that the whole matter was up for consideration as late as last January, when the Department of Electricity was created. The ordinance establishing the new department contained a detailed list of the fees to be charged for electrical inspection, and the text was printed in full in this journal while the ordinance was pending in the City Council. At that time the Western Electrician called attention editorially to the fact that the ordinance related principally to electrical inspection, and there was time for an effort to have been made to secure a lower scale of fees. But no such effort was made, and the ordinance became a law with the old schedule of fees.

It is true that the city's charges for inspection are 30 per cent. higher than would be necessary to make the bureau of inspection merely self-sustaining; but it is a great exaggeration to say, as the Chicago Record did in mentioning the West Sider's complaint, that "last year the fees form the inspection of electric lights paid into the city treasury amounted to $80,000." The annual report of City Electrician Ellicott for the year 1897 shows that the total receipts of electrical inspections for that year were $16,248.52. The total expense of making the inspections was $10,910.18.

By effecting a consolidation of the smaller electric-lighting companies of Chicago under one management in the Commonwealth Electric company, President Insull has not only assured harmonious relations between the Chicago Edison company and the several properties represented in the new corporation, but he has made it possible to put into practice in the outlying districts of Chicago the same principles of concentration and unification that have proved so successful in the Chicago Edison company. While the properties now combined in the new corporation were being operated independently the business became greatly demoralized, especially upon the South Side, and not only were the plants run at a loss to the owners by reason of the fierce competition that existed for a protracted period, but the service degenerated and the industry suffered in consequence of these conditions. It is now proposed to conduct the several plants upon an economical basis consistent with efficient service. Probably several of the old stations will be shut down and the territory divided into new districts; eventually the entire system is to be reorganized and rearranged, modern methods of generation and distribution introduced and the general efficiency considerably raised, while the operating expenses will undoubtedly be decreased. The experience thus far gained, even with the present facilities, shows that many economies can be introduced. The policy of the management is indicated by President Insull in his statement of the condition of the property. He mentions the fact that an extremely favorable operating contract for the period of the life of the bonds, 45 years, has been formally executed between the Chicago Edison company and the Commonwealth company, giving the latter the right to call upon the Edison company to supply current to feed the Commonwealth company's system at a very low cost of production, and then he adds:

It will probably be the policy of the Commonwealth company to take advantage of this contract whenever the demand on it for current shall exceed the present capacity of the Commonwealth company's plants, and if it shall be found cheaper to abandon these plants eventually for generating purposes and take current entirely from the Edison company, the Commonwealth company will have the contract right to pursue that course. In that event it would probably maintain in its own territory only a portion of its present plants for use in connection with transforming the current to the pressure necessary for delivery over its own system.

In other words, provision is made for a still closer relationship with the Edison company, should such a plan be deemed advisable. It is plainly the intention of the controlling spirits to have the Chicago Edison company furnish current for a portion of the outside district through the Cosmopolitan company, and should the arrangement prove satisfactory this scheme may be extended indefinitely. Neither company, however, is committed to any fixed policy, and the management of both is given absolute authority to work out a system that shall be satisfactory and economical to all concerned. The development of the plans of the combination will be followed with a good deal of interest, as the territory covered is not only very large and the property very valuable, but the possibilities presented are unusually promising.

The inquiry of the parliamentary committee into the telephone service of Great Britain has been concluded and the report has been prepared, but the formal document has not yet been given to the public. The findings of the committee have been ascertained, however, and they are now under discussion in the daily and technical press of England. The committee decided practically unanimously that the telephone service is not at present of general benefit, either in the United Kingdom at large or in those limited portions of it where exchange areas exist. Thus the tendency of the present arrangement of having the trunk lines in the hands of the Postoffice is considered inequitable. It was found that one tendency of this system was to limit the use of the telephone service, especially the trunk lines of the government, to the company's subscribers, although the system had been established and was maintained at the expense of the taxpayers. In other words the lines are engineered and erected out of public funds, and only a limited number of taxpayers, who also subscribe to the National Telephone company, are able to get any benefit from the expenditure. The second finding was in relation to the authority of the Postoffice to compete in any area, either itself or by means of licensees. On this point the contradictory evidence given by the company's officials and by the government's representatives had to be considered by the committee. The committee finally decided unanimously that the Postoffice has a right to compete, and it added that competition of some sort was both expedient and necessary, provided certain precautions are adopted. It is pointed out that this competition will tend to extend and popularize the service and avoid a danger, which is by no means remote if no alternative system is in operation, that a purchase of the company's undertaking at an inflated price may be forced on the government at the expiration of the period of the present license. The reservation is made, however, that the licenses of both the company and any municipality should lapse together, so that the Postoffice may have the opportunity of acquiring all telephone systems if it should choose in 1911. The committee insists in granting new licenses to municipalities upon other conditions, such as a complete metallic circuit, the payment of a 10 per cent. royalty to the Postoffice, the prohibition of any desire to carry on the service at a profit with a view to lightening the burden of local taxation. It is contended also that a minimum rate should be imposed to protect the Postoffice against a reduction of rates to a point which would involve an unremunerative service after 1911.

Although the conditions prevailing in Great Britain are entirely different from those that obtain in this country, the result of this investigation is important. It establishes the fact that competition is deemed desirable in England, as it is known to have proved advantageous in other European countries. The National company's franchise expires in 1911, and it is believed an effort will be made to force the government to purchase the property or renew the privileges under equally favorable terms to the company. However, the English people have grown tired of the monopoly just the same as Americans, and the tendency toward a new order is plainly marked.

Commonwealth Electric Company.

The Commonwealth Electric company of Chicago is now fairly launched. All the preliminary arrangements for the consolidation and absorption of the central-station systems of Chicago outside of the territory occupied by the Chicago Edison company have been perfected and a working arrangement made with the Edison interests; the securities of the new company have been satisfactorily placed and the permanent organization has been effected by the election of the following-named officers on Monday afternoon: President, Samuel Insull; vice-president, Robert T. Lincoln; secretary and treasurer, Frank S. Gorton; comptroller, Walter M. Anthony; general superintendent, Louis A. Ferguson; directors, Edward L. Brewster, Joseph Leiter, John J. Mitchell, Samuel Insull and Robert T. Lincoln. These gentlemen occupy similar positions with the Chicago Edison company.

A very favorable arrangement has been made between the two corporations, under the terms of which the Chicago Edison company will continue to occupy the downtown business district and the territory immediately bordering upon it, while the Commonwealth company will care for the district north of North avenue, west of Ashland boulevard and south of Thirty-ninth street. It is estimated that the population of the outside district is 750,000. The territory served by the combined Edison and Commonwealth interests is 33 miles long, eight miles wide and extends from South Evanston on the north to a point just across the Indiana line on the south. This combination of interests represents a cash investment of upwards of $12,000,000 in the electric-lighting business of Chicago and its suburbs.

The new corporation was formed to operate under the 50-year franchise known as the Commonwealth ordinance, and the following properties were acquired: On the South Side, People's Electric Light and Motor-power company, Mutual Electric Light company, Hyde Park Thomson-Houston Light company, Hyde Park Electric Light and Power company, Englewood Electric Light company, People's Light and Power company; on the West Side, West Chicago Light and Power company, and on the North Side, Western Light and Power company and Edgewater Light company. In addition to these equipments the following-named franchises were secured: Garfield Electric Lighting company on the West Side; Western Electric company on the South Side; Fort Wayne-Jenney Electric company, Lake Electric Lighting company and Town of Lake Electric Lighting company in the Town of Lake; Lake View Electric Light company in the city of Lake View. The cost of these stations, franchises, etc., amounted to $2,600,000. They have all been formally transferred to the new corporation and will hereafter be operated under one management. This will result in a considerable saving, as it will reduce the operating forces needed and the number of plants and separate organizations. In the official prospectus it is asserted that "although the advantages of consolidated management have hardly been demonstrated, the annual net earnings on the basis of the business for the month of July are more than sufficient to pay all fixed charges. It is estimated by the president that there will be a gradual and steady increase in both gross and net earnings."

The company has issued bonds amounting to $2,150,000, all of which have been disposed of. Of this amount, bonds for $150,000 are held in escrow by the Northern Trust company for the retirement of $50,000 outstanding bonds of the Hyde Park Thomson-Houston Electric Light company and $100,000 outstanding bonds of the Hyde Park Electric Light and Power company, for the purchase or exchange of which arrangements are now pending. The bonds are secured by a deed of trust by way of mortgage, covering the entire property, rights, privileges and licenses of the Commonwealth Electric company, to the Northern Trust company of Chicago. After the retirement of the $150,000 outstanding bonds just referred to, the mortgage will be a first lien on all property and rights of the Commonwealth company. Under the restrictions in the mortgage, further bonds to the amount of $350,000 can be issued only for the acquisition of new property to form a part of the company's permanent investment; and additional bonds in excess of $2,500,000 can only be issued for 75 per cent. of expenditures for the further acquisition of new property of like character. The mortgage requires the company to invest all its surplus earnings over fixed charges for a period of five years from the date of the mortgage in acquiring such property. After the expiration of this period a depreciation reserve fund is provided for, requiring the company thereafter to add to its permanent investment at least $17,000 per annum for each $1,000,000 par value of outstanding bonds. The amount of such reserve fund cannot be included as a basis for the issue of additional bonds.

The entire available issue of $2,000,000 was taken by a syndicate formed by Edward L. Brewster & Co. and N. W. Harris & Co. The London Scottish-American Trust company subscribed for $500,000 through its agents in this country, Aldis, Aldis, Northcote & Watson, and another block of $300,000 has been practically sold, although the transfer has not yet been completed. The members of the syndicate subscribed for $700,000 for permanent investment and the remaining $500,000 is now placed on the market by N. W. Harris & Co. It is understood that the bonds were placed on the market at 97½. This favorable consideration of the proposition was due doubtless to the harmonious relations between the Commonwealth and Edison companies. An operating contract for the period of the life of the bonds has been formally executed between the two companies, giving the Commonwealth the right to call upon the Edison company to supply all the current necessary to feed the Commonwealth company's system at a very low cost of production. This contract provides that if at any time the interest on the Commonwealth bonds should be unpaid, all moneys accruing to the Edison company under the contract, pending such default shall be paid to the trustee to be used in paying matured interest coupons, the Edison company allowing the payment of interest by the Commonwealth company in preference to its own claims. It will thus be seen that the Edison company practically stands sponsor for the payment to the extent of moneys accruing to it under the operating contract of the interest on the bonds of the Commonwealth company.

President Insull has prepared a statement showing the condition of the property of the new corporation, in which he says:

The gross earnings of the various systems now owned by the Commonwealth company for the year 1897 were approximately $333,000. The net earnings for that period were $75,700. Nine different stations were being operated and their separate systems of conductors maintained, so that the economical production of electric current was impossible. On April 1, 1898, the Commonwealth Electric company took over the various properties, but did not commence economizing in operating expenses until about the 15th of May, since which time, without any increase in prices, the following results have been obtained:

	Monthly Gross income.	Monthly expenses.	Net earnings.	Average per year.
May	$25,914.40	$19,077.77	$6,836.63	$ 82,039.56
June	27,474.27	18,058.91	9,415.56	112,984.32
July	27,517.31	17,771.28	9,716.03	116,952 36

The figures are based upon the operation of the plants without the advantage of the operating contract made with the Edison company, the advantages of which will increase as the business of the Commonwealth company is extended.

You will understand that at the present time the company is working under very decided disadvantages, as the reorganization of the properties is by no means complete. While several of the plants have been consolidated, the company is still operating with six different systems in the territory reached by its circuits. The incandescent business has not as yet been developed at all in the West Side territory it proposes to occupy, but the company is now building an extensive system west of Ashland boulevard in a locality which must yield a considerable revenue.

The total fixed charges of the Commonwealth company, under a bond issue of $2,000,000 and including the interest on the underlying bonds, will amount to $109,000. The fact that these fixed charges are more than taken care of on the basis of such annual net earnings as are shown in June and July, is, I consider, an extremely favorable showing, especially as the months of June and July contain the shortest nights in the year and are, therefore, the most unfavorable months for the electric lighting business. It is a conservative estimate that the net earnings before the lapse of a year's operation of the consolidated properties will be at the rate of $140,000 per annum.

In financial as well as in electrical circles the successful completion of this arrangement between the Commonwealth and Edison properties in Chicago is regarded as one of the most important transactions in the electric-lighting interests of the country. President Insull has devoted much time and attention to the details of the undertaking, and the successful outcome of the negotiations is due largely to his untiring efforts.

Ohio Electric Light Association.

There was a full attendance and much interest in the fourth annual meeting of the Ohio Electric Light association, held in the West House, Sandusky, on Thursday and Friday of last week. The programme, given two weeks ago in the Western Electrician, was adhered to, and it was declared on all hands that the convention was the most interesting and best attended yet held by the association. The entertainment features were excellent, and the efforts of the gentlemen in charge of them were highly apereciated.

In his address the retiring president of the association, Mr. H. K. Wood of Piqua, O., recalled the fact that he attended the first meeting to form a state association in Pennsylvania, back in the spring of 1885, when there were probably not more than five stations in Ohio selling incandescent light. At that time, Mr. Wood said, he had the pleasure of meeting Mr. John I. Beggs, who was then manager of the "model Harrisburg plant." Mr. Wood briefly referred to the municipal-ownership question, to the need of vigilance and co-operation and to the promising outlook for business. He showed by a little table that the association had grown from 37 members in 1895 to 61 members on August 17, 1898.

Papers and addresses were read or delivered as follows: "The Meter's Relation to the Dividend," by Caryl D. Haskins of Boston; "Positive and Negative Economies in Small Central Stations," by Professor E. P. Roberts of Cleveland; "Long-distance Transmission of Power," by E. J. Berg of Schenectady; "Some Suggestions Relative to Determining the Cost of Electrical Supply," by M. E. Turner of Cleveland; "Comparative Commercial Qualities of Old and Modern Transformers as Applied to an Exchange," by J. H. Perkins of St. Louis. There was also a question-box, and much advantageous discussion resulted.

Officers were selected as follows:

President—Emil G. Schmidt, Sandusky, O.

Vice-president—B. P. Holmes, Youngstown, O.

Secretary and treasurer—Samuel Scovil, Cleveland, O.

Executive committee—H. K. Wood, Piqua, O.; B. P. Foster, Norwalk, O.; George Matt, Lancaster, O.; E. H. McKnight, Middletown, O.; S. Griffin, Lorain, O.

Finance committee—Albert Thomas, Dayton, O.; Thomas Espy, Kenton, O.; John L. Town, old Luna, O.

The association will meet in Cleveland next year.

Electricity at the Paris Exposition.

It is proposed to have a creditable representation of electrical industries at the Paris exhibition of 1900. Mr. Peck, the recently appointed commissioner-general for the United States, has published the rules and general classification of the exposition for the information and guidance of Americans. Under the rules it is provided that exhibits shall be divided into 18 groups. Machinery and Processes of Mechanism are included in Group IV., but a separate classification of Electricity is made in Group V. as follows:

CLASS 23.

Machines and Appliances for Producing and Utilizing Electricity.

Dynamos of direct and alternating currents; constant or varying quantity.
Transmission of electrical energy. Electric motors: direct constant current, alternating currents.
Transportation by electricity: electric engines, electric tramways.
Regulation of the electric currents; dynamos for alternating currents.
Appliances of electricity in mechanics: elevators, cranes, windlasses, capstans, magnetic warping, swing bridges, trolleys etc.
Safety and registering machines.

CLASS 24.

Electro-chemistry.

Electric batteries.
Accumulators.
General processes of electro-plating. Electro-metallic preparations.
Refining of metals and their alloys.
Appliances of electricity to industrial chemistry: bleaching, disinfection of drains, manufacture of soda, chlorine, chlorate of potash, etc.

CLASS 25.

Electric Lighting.

Systems of direct and alternating currents.
Arc lamps. Indicators. Carbons.
Incandescent lamps.
Fittings for private houses, studios, factories and public buildings.
General depots of electricity.
Appliances for lighthouses, military purposes, navigation, public works.
Safety appliances and registering meters.
Photometry. Apparatus for determining power and distribution of electric light.
Material for ornamental electric lighting with chandeliers, etc

CLASS 26.

Electric Telegraphy and Telephones.

Telegraph apparatus; transmitting and receiving apparatus
Various apparatus and appliances.
Apparatus for simultaneous transmission.
Special devices. Lightning conductors.
Transmission of words. Telephones and microphones.
Appliances and apparatus used in central offices; switchboards.
Simultaneous telegraphic and telephonic communications.
Telegraph and telephone conduits. Open air, underground and submarine cables.

CLASS 27.

Various Applications of Electricity.

Scientific apparatus and instruments for measuring.
Electricity in surgery, dentistry and therapeutics.
Electric clocks.
Application of electricity to railways, mines and public works
Electric signals. Electricity in the ignition of explosives.
Long-distance indicators and registering appliances for phenomena of various descriptions.
Electric heating furnaces.
Electricity for soldering iron, etc.
Apparatus and appliances for heating by electricity.

Electrical appliances are also included in Group VI. under "Equipment for Mercantile Navigation," where "special apparatus for producing and using electricity" may be entered. Submarine navigation naturally includes similar apparatus. In Metallurgy, Group XI., and Chemical Industries, Group XIV., electricity forms an important feature. Group XVIII., which comprises "Military and Naval" exhibits, has special departments for electricity and its applications in warfare. The telegraph and telephone are particularly mentioned.

Two Presidents Exchange Compliments over the New French Cable.

Felicitations between President McKinley and President Faure were exchanged on August 17th by cable, in honor of the conclusion of the new trans-Atlantic cable from Cape Cod to Havre. The message of the French president, who was at Havre, was electrically transmitted direct to the White House at Washington. The occasion was observed as something of a state function, the French ambassador, the first secretary of the French embassy, the acting secretary of state and other dignitaries attending President McKinley at the Washington end of the line. The message from M. Faure and Mr. McKinley's answer were expressed in conventional phrases.

The completion of the line was accomplished in midocean, the two cable ships approaching each other from the American and the French sides of the water and linking together the two ends. The line is a renewal of the old French line running from Cape Cod, Mass., to Havre, France. It is said to be the longest cable line in the world, the other Atlantic cables being shortened by touching at Nova Scotia. The exchange is the second of the kind which has occurred, President Buchanan and Queen Victoria having exchanged congratulations on August 5, 1858, when the first Atlantic cable was laid.

DEVELOPMENT OF THE TELEPHONE FIELD.

Evolution of the Line Signal.

By Arthur Vaughn Abbott.

Part III

When first used as signals, the lamps were placed in the local of a relay actuated by current passing over the line to which the signal was attached. In the early attempts the ordinary telegraph relay was employed, armed with extra heavy platinum contacts to prevent burning. It seemed possible to obviate the expense of installing and maintaining this relay by an appropriate lamp directly in series with the subscriber's line, so placed that the removal of the telephone from its hook should close the circuit and light the lamp. This experiment was first tried in the Chicago express office and, on the whole, worked passably well, there being a comparatively small mortality of lamps due to short-circuits and other accidents. A continuation of this experiment was attempted in another office, but resulted disastrously, as the lamps were burned out so rapidly as to cause an excessive maintenance expense. The occasion of this failure is to be ascribed to a preponderance of aerial lines in the last case. A wind-cross occurring near the office on a long line would subject the lamp to an abnormal voltage and either injure or immediately destroy it. In an express office, where the lines were chiefly underground, little or no trouble was experienced from this cause, and in an office in St. Louis, similarly equipped with lamp line signals placed directly on the subscriber's line, the use of a very heavy filament lamp obviated the difficulty experienced with injury to lamps. But while economy in installation due to the omission of the relay is eminently desirable, present experience decidedly indicates that the relay is essential to the successful lamp signal.

For this purpose rather an interesting type has been evolved in an attempt to consolidate the relay, lamp and socket into a single piece of apparatus and at once obtain a device which should be absolutely dust-proof and free from trunnion trouble. A general view of this relay, which was developed largely with the assistance of Mr. M. A. Edson of the Chicago Telephone company, is shown in Fig. 9 and a section in Fig. 10.

From the latter illustration it will be seen that the front end of the "lamp relay," as it is termed, consisted of a brass tube A, forming the lamp socket, carrying the screw at the bottom, supplied with round glass cap, carrying the subscriber's number. From the rear of the socket extends a core B of soft iron surrounded by an iron tube C, between which the winding space was obtained. A hemispherical brass cap D covered the end of the iron tube, retained in its place by an appropriate set screw. The inside of this cap was hollowed out, containing a piece of sof ironE, in the form of a frustrum of a cone, that constituted the armature. As this piece of apparatus was set horizontally the armature rested upon its edge in an unstable position, tending to settle backwards and rest against the back of the cap. The excitation of the windings magnetizes the core, and, attracting the armature, draws it up sharply. A thin platinum spring placed on the front face of the armature serves to make contact with a corresponding platinum point set in the center of the core. As the core is insulated from everything but one lamp wire, while the other is connected to the cap, the excitation of the relay lights the lamp. By this device a relay was obtained, the moving parts of which were completely dust-proof. All trunnions or hinges were obviated, and the armature merely resting upon a sharp edge secures a minimum amount of friction. Notwithstanding the compactness and completeness of this piece of apparatus, it has been found desirable to disassociate the relays and lamps, placing the relays in a case by themselves, away from the switchboard.

Probably the most gratifying feature in the evolution of the line signal has been the improvement in the life of miniature lamps. When the luminous signal was first proposed the question of cost of lamp renewals was at once raised. As each lamp was only illuminated for a few seconds at a time, the service seemed equivalent to constant flashing, and ominous prophecies were plenty as to the short life to be expected. It was confidently asserted that such small lamps would either immediately burn out, or else so rapidly become dim as to be valueless as signals. Some tests were immediately instituted in the hope of eliciting information on these points. There was no question but that the candle power of the lamps gradually declined, and photometric measurements showed that when a lamp failed to emit at least .05 candle power, it became of no value as a signal.

To determine the resistance to flashing, a number of lamps were connected in circuit with a clock pendulum and flashed at intervals one second for nearly a month, with no signs of serious injury. During this test the lamps were illuminated more than a million times, so it seemed certain that a reasonably long life could be expected. Experience has since shown this conclusion to be justified, for in the main-office switchboard in Chicago there are now lamps at work that have been in service for upwards of three years and seem still to be in fairly good condition. Observation has further shown that accidental injuries, rather than old age, is the cause of most lamp failures.

Much delay was experienced in obtaining the first lot of switchboard lamps, so on reception they were immediately placed in service without inspection. The rapid failure of a large number of these caused no small degree of consternation, and it was determined to initiate a systematic inspection. As a result, all lamps are now examined (1) mechanically, to see if they will fit the sockets; (2) electrically, to determine if they have the proper voltage and consume current within the specified limits; (3) optically, to ascertain if they emit the required candle power and absorb the proper watts per candle. Also, a certain number of lamps from each lot are placed on life test and burned to destruction.

In Fig. 11 four curves are given that show at a glance the improvement that has taken place in lamp life. The dotted lines are curves of life and candle power of 10 samples, each of 10 and 20-volt lamps tested in 1895, while the full lines are the results from 20 samples of 10 and 20-volt lamps of the present date. In 1895 only 200 hours life could be expected, while from the latest tests the 20-volt lamps show 2,400 hours life before failure, and the 10-volt lamps show 2,500 hours, and are still burning with indications of considerable additional life.

In Fig. 12 is an interesting comparison of the rate of failure of sample lamps tested in 1897 and at the present time. Curves 1, 2, 3 and 5 are for 20-volt lamps of different makers, while curve 4 is for four-volt lamps. The ordinates are the number of lamps on test at the various times represented by the abscissæ in hours, so that the life of each lamp is plainly shown. The four-volt lamps failed almost immediately, only yielding upwards of 50 hours. The 20-volt lamps, curves 1, 2 and 3, tested in 1897, gave upwards of 600 hours life as an average, those indicated by curve 1 showing the greatest uniformity. In curve 5 the results of 10 20-volt lamps tested this spring are plotted; one lamp failed after 40 hours, but the filament was manifestly defective at the start. Nineteen lamps lasted over 1,900 hours and one lamp over 2,500 hours.

In Fig. 13 the curves of 10-volt lamps tested in a similar manner are shown. These results indicate a much greater irregularity for the 10-volt lamps. The lamps of curve 3 make a bad showing, only one lamp lasting over 40 hours; those of curves 1 and 2 are much better, indicating a life of 400 hours, but still are much below the life shown by the 20-volt lamps. Curve 4 represents the results of tests upon 20 10-volt lamps recently manufactured. This curve is a straight line for 2,500

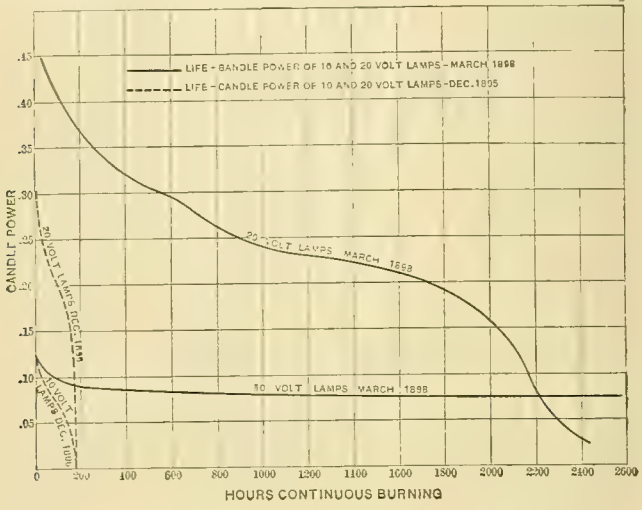


Fig. 11.

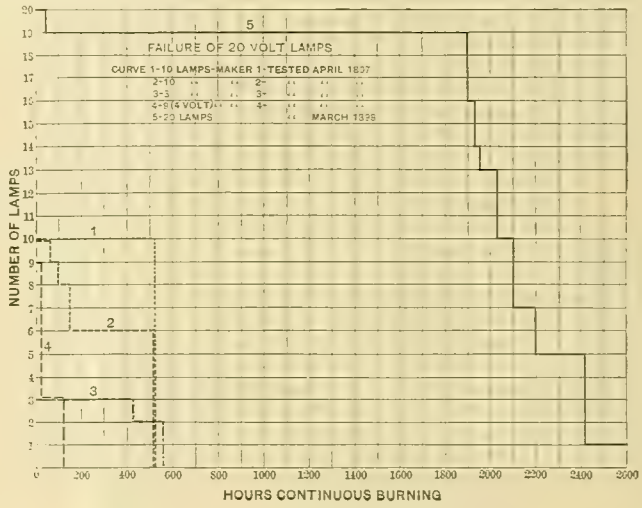


Fig. 12.

EVOLUTION OF THE LINE SIGNAL.

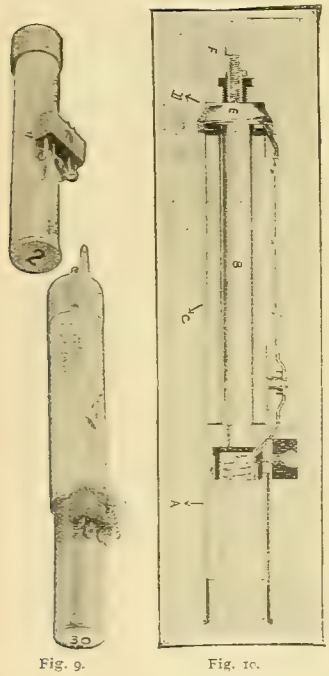


Fig. 9.

Fig. 10.

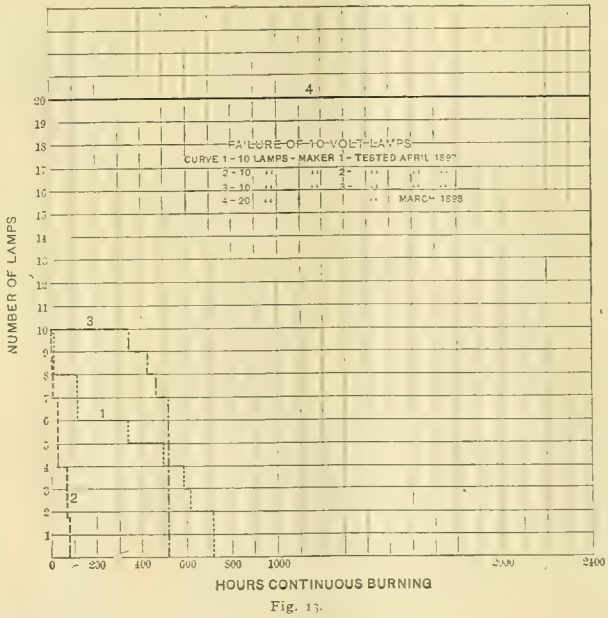


Fig. 13.

EVOLUTION OF THE LINE SIGNAL.

hours, showing that so far no failures have occurred, and from the appearance of the filament, it is reasonable to expect several hundred hours more life.

In Fig. 14 some information is plotted relative to candle power, life and voltage of 20-volt lamps. Curves 1, 2 and 3 show the relation between the life and candle power of 20-volt lamps when placed upon circuits of respectively 21, 20 and 18½ volts. The left-hand scale in candle power applies to these lines. Curve No. 4 is a life-voltage curve, for which the scale of volts on the right-hand should be used. For all these curves the abscissæ are in hours. These lines strikingly illustrate the relation between life and candle power. As switchboard lamps are usually supplied by 10 cells of storage battery, it is impracticable to always maintain them at precisely a constant potential, for the pressure is likely to vary one or two volts from that of full charge to that of discharge, and regulating resistances are more expensive than decreased lamp life. Even at the highest pressure, it is interesting to note that the lamps at present show a life of over 1,400 hours.

Lamp experts will at once infer that improved life is obtained by a lamp of low efficiency and will urge the cost of the current as an insuperable objection. The total cost of a luminous signal is evidently the cost of the lamp, plus the cost of current consumed during its life, and it is easy to show that this is a minimum when the cost of the energy consumed is equal to the cost of the lamp. Switchboard lamps now cost in the neighborhood of 45 cents each. With a life of say 2,000 hours, the cost of energy is about 60 cents, but it has been shown that accidental causes tend to reduce the actual life in the switchboard far below that shown by laboratory tests, and it is doubtful if the average lamp lives for 1,200 hours. Unless accidental destruction can be greatly reduced below the present amount, the cost of the lamp is now considerably above the cost of energy during its life and a still lower efficiency could profitably be employed, for it must be remembered that the thick, heavy filament in the low-efficiency lamps is the best insurance against accidental injury. Theoretically, subscribers' line lamps should last 25 years; cord supervisory lamps from one to two years; trunk-line lamps the same length of time, and pilot lamps from three to six months. Such a life as this has been obtained in the cord and pilot lamps, but it is doubtful if the theoretical limit for the line lamps will ever be closely approximated.

Even in the present probably only partially developed state of the luminous signal, some 20,000 subscribers are now served upon boards thus equipped, and switchboards for as many more are in process of construction. Aleady the adoption of this form of signal has materially modified the arrangement and design of switchboard apparatus, and has been so efficient a factor in the improvement of telephonic service that it is difficult to prophesy the end of its effect.

In conclusion, the writer is only too glad of an occasion to express his appreciation of the promptness with which the various lamp manufacturers have taken up the problem of the line lamp signal, in the solution of which they have spared neither pains nor expense.

FIG. 14. EVOLUTION OF THE LINE SIGNAL.

Independent Telephony in Canada.

The same tactics are employed in Canada by the Bell interests as in this country, judging from the recent experience of the People's Telephone company of Sherbrooke, Quebec, the independent corporation that is operating in that territory. At a recent meeting of the City Council the right of the independent company was questioned by the chief of police, who has charge of locating the poles of electric companies. This official seems to be more than earnest in his advocacy of the Bell interests; in fact, his zeal has outrun his discretion, and his actions on behalf of the Bell interests have been severely criticised.

Mr. C. Skinner, the manager of the independent interests, in a communication to the Daily Record of Sherbrooke, calls attention to the course pursued by the chief of police. He charges that that official has attempted to keep the field clear for the Bell company. It is evident that he has done everything in his power to place obstacles in the way of the new company. He has even gone so far as to refuse to communicate personally with the manager of the new company. It now appears that his course has disgusted the people of Sherbrooke, and that an investigation may be made into the condition of affairs.

Illinois Telephone Association.

The programme for the meeting of the Illinois Telephone association at DuQuoin on September 28th and 29th has been prepared. It is proposed to hold three sessions, the first on the afternoon of Wednesday, September 28th, and the others in the morning and afternoon of Thursday. The banquet will be held Wednesday evening. There will be an exhibition of apparatus in connection with the meeting.

At the opening session Dr. Lumpkin will make an address, and two papers will be read. The title of the first is "Past, Present and Future Apparatus," by P. J. Hertz of the Ericsson Telephone company, New York. The second will be on "The Evolution of the Telephone Signal," by H. P. Clausen of the Western Telephone Construction company, Chicago.

The second day will be devoted to the reading and discussion of papers on the following topics:

"To what extent under the present conditions should independent companies make an effort for through business," by J. J. Nate of the Standard Telephone and Electric company of Madison, Wis.

"Best methods of protecting against lightning, foreign currents, cross-talk, etc.," by the Stromberg-Carlson Telephone Manufacturing company of Chicago.

"General construction of toll lines and best methods of connecting same for through and local business," by the American Electric Telephone company of Chicago.

"Merits of grounded, common-return and metallic systems as applicable to small exchanges," by the Sterling Electric company of Chicago.

"Batteries for exchange and toll-line work from a point of economy and excellence of service," by S. A. Dinsmore of the Electric Appliance company of Chicago.

"Farm Lines—Have they proved a source of revenue, and should they be encouraged?" General discussion.

"Growth and development of the telephone business in the state of Illinois within the last three years," by A. M. Howell, secretary of association, Hillsboro, Ill.

"Accounts and settlements between toll-line companies," by J. W. Hamilton, auditor Douglas County Telephone company of Tuscola, Ill.

"Liability of toll-line companies as common carriers under existing laws, and needed legislation," by Angus Leek, attorney for the Cairo Telephone company of Cairo, Ill.

"Progress of the independent telephone business in the West, outside of the state of Illinois," by James S. Cuming of the Central Telephone and Electric company of St. Louis.

Extensions and Improvements.

The [illegible] Telephone company has been incorporated with a capital [illegible] with headquarters at Alvin, Missouri, by O. S [illegible] W. Williamson and W. A. Leonard.

The Mountain Home and [illegible] Telephone company has been incorporated at Mountain Home, [illegible] The capital [illegible] are C. W. Brown, president [illegible] B. E. Massey, R. C. Paul, W. [illegible] Love, directors.

Frank Bell of the Inland Telephone company [illegible] on his way to Rossland to secure a route for the new line to be constructed from Spokane [illegible] to Rossland before next fall. The company is now putting in a local telephone exchange at [illegible]. It has applied to the council for a 30-year franchise. The company has sent an agent to Marcus, where it is at present looking for a franchise.

Manufacturers of telephone apparatus and supplies will be interested in the announcement that the Baltimore and Bel Air Telephone company, Wilna, Md., of which J. Alexis Shriver is secretary, wants to correspond with manufacturers of telephone equipments of all kinds, and that J. C. Pike of Bolivar, Mo., wants to buy an entire telephone equipment of about 100 telephones and a switchboard for the system.

The American Bell Telephone company has a force of about 200 men at work pushing the line from Decatur, Ala., to Birmingham and Montgomery. A large gang of workmen is erecting two towers 120 and 140 feet in height, used to throw the wires across the Tennessee River, this plan being adopted in place of using the Southern railway bridge, as was at first proposed. The workmen say the line will be completed and in running order in six weeks. The "swing" across the river from tower to tower is nearly a mile in length, the four wires being of copper and weighing about 1,000 pounds each.

In Asheville, Tenn., the Board of Trade is pushing a movement for more reasonable telephone rates. A committee composed of T. S. Morrison, James P. Sawyer, W. R. Northup, E. R. Lucas and W. B. Williamson has been appointed to investigate the merits of other telephone systems than the Bell. A sub-committee composed of W. B. Williamson and W. B. Northup has obtained 300 signatures to a contract with a competing company which it is proposed to patronize.

The South Fork branch of the Pennsylvania railroad has had a telephone system put in and the road is now being operated by telephones. Dispatchers to the round-houses, employes and switchmen get orders by telephone. In the yards of the Pennsylvania railroad almost every shed, tower and office is equipped with telephones, scores of telegraph instruments have been removed, and operators discharged, it is said. Yardmen answer the ring of the phone. It is estimated that thousands of dollars are saved annually in wages formerly paid telegraph operators.

The Western Canada Telephone company, limited, has been incorporated with a capital of £60,000 in £100 shares, to acquire, develop, and deal with any telephone lines and any machinery, plant, effects and shares of any telephone company in British Columbia or Canada, and to carry on the business of financiers and company promoters. The subscribers are J. Whatley, Woodlands, Mirfield; J. Crowther, Woodley, Huddersfield; W. D. Shaw, Holmefield, Ladywood; G. Sheard, Woodlands, Batley; R. I. Critchley, Hyrst House, Dewsbury; F. Priestman, Pierremont, Manningham, Bradford; J. H. Wade, Bradford.

Contracts are being made by the Bell Telephone company of Missouri with St. Louis druggists for placing automatic telephones in business places. The subscriber agrees to collect tolls to pay to the company, and, in lieu of compensation, the company agrees to pay the subscriber a commission of 10 per cent. on all receipts for messages sent from each station to some other station in the cities of St. Louis or East St. Louis, connected with an exchange of the company, and also on long-distance messages. The company will attach to each set of instruments a coin-receiving device for city messages, the same as are now in operation in other cities.

The Lafayette (Ind.) Harrison Telephone company, one of the pioneer companies in the independent field, has been compelled to remodel its exchange quarters. The company has closed a contract with the Sterling Electric company of Chicago for a complete equipment consisting of switchboards, distributing boards and combined cable terminals and protectors for a capacity of 1,000 subscribers. This plant will be installed before September 1st. The Sterling company has also secured an order from the Mutual Telephone company of Des Moines, Iowa, for a new metallic-circuit switchboard of 2,000 wires capacity to be installed before September 15th. The Sterling company is furnishing to the Schance & Fair Electric company of Chrisman, Ill., and the Plymouth Telephone company of Plymouth, Ind., sections of standard metallic-current switchboard of the Bell pattern, which will replace the old style boards now used by them.

International Acetylene Association.

At the recent meeting of acetylene-gas generator manufacturers in Chicago an organization to promote the business of lighting by acetylene gas was organized under the name of the International Acetylene association. The meeting was called in response to the feeling that has prevailed among manufacturers of acetylene apparatus that there should be some central body to take up the questions relating to this comparatively new business in a comprehensive manner, which would avoid much duplicated work and misdirected effort and at the same time dispel the somewhat prevalent belief that it belongs as yet to the realm of theory and experiment, giving to the business a commercial standing in the minds of the public generally. Invitations were sent to manufacturers whose generators had received the approval of the governing committee of the Western Union of Fire Underwriters. The following-named gentlemen were in attendance:

Barton, I. R., Patterson Generator company.....Batavia, N. Y.
Carroll, J. B., Modica & Carroll company.....Chicago.
Corrigan, Philip, Beucus Acetylene Generator company.....Cedar Springs, Mich.
Earl, J. W., National Sunlight Gas company.Minneapolis, Minn.
Finkler, C. C., Niagara Falls Acetylene Gas Machine company.....Niagara Falls, Ont.
Geissel, Henry, H. Geissel & Co.....Chicago.
Gellenbeck, E. J., Shakopee Acetylene Gas Generator company.....Shakopee, Minn.
Hansen, J. M., Crane & Ordway.....St. Paul, Minn.
McClintock, J. M., Adair Gas company.....Adair, Iowa.
Modica, F. B., Modica & Carroll company.....Chicago.
Moody, C. D., Moody & Offutt.....Louisville, Ky.
Owen, George F., G. F. Owen company.....Grand Rapids, Mich.
Robinson, W. C., Chicago Board of Underwriters.....Chicago.
Wangler, Charles J., Missouri Acetylene company. St. Louis, Mo.
Wheeler, M. B., M. B. Wheeler Electric company.....Grand Rapids, Mich.
Wilson, George L., F. Cortez Wilson & Co.....Chicago.
Young, G. W., Epworth Gaslight company.....Epworth, Iowa.

The following-named companies expressed by letter their intention to be represented at the convention, but afterward found it impossible to carry out their intention, and requested notification of the proceedings taken, with a view to joining any organization that might be perfected: American Gas Light company, St. Louis, Mo.; American Incandescent Gas company, Kansas City, Mo.; Bruce Generator company, St. Paul, Minn.; W. A. McCune, Chicago; Price Manufacturing company, Gnadenhutten, O.; Sun Acetylene Gas Generator company, Mount Clemens, Mich.

The various relations of the acetylene interests were fully discussed at the meeting. One of the speakers was Mr. W. C. Robinson, who advocated the co-operation of the proposed organization with the insurance companies. The monopoly of the production of carbide was considered at length, and when the constitution was adopted the first of the standing committees provided for was that on carbide. Another subject of importance was the design of a standard and safe generator.

The constitution adopted states that the membership of the association shall be limited to manufacturers of acetylene-gas generators and manufacturers of carbide. The principal office is in Chicago, and stated meetings will be held in January and July of each year, always in Chicago, unless otherwise designated by the executive committee.

Officers and committeemen were selected as follows:

President—George Landis Wilson, Chicago.
Vice-president—J. W. Earl, Minneapolis, Minn.
Secretary—J. B. Carroll, Chicago.
Treasurer—C. D. Moody, Louisville, Ky.
Directors—George F. Owen, Grand Rapids, Mich.; I. R. Barton, Batavia, N. Y.; Charles J. Wangler, St. Louis Mo.

Committee on Carbide—F. B. Modica, Chicago; I. R. Barton, Batavia, N. Y.; M. B. Wheeler, Grand Rapids, Mich.

Committee on Insurance—C. C. Finkler, Chicago; G. W. Young, Epworth, Ia.; Philip Corrigan, Cedar Springs, Mich.

Committee on Transportation—Henry Geissel, Chicago; J. M. McClintock, Adair, Ia.; E. J. Gellenbeck, Shakopee, Minn.

Submarine Cable News.

The Hongkong-Manila cable has been repaired by the signal-service corps of General Merritt's army. Admiral Dewey picked up the severed ends of the cable on the day Manila surrendered, but communication was not established until August 20th. Among the first dispatches to go over it were President McKinley's congratulations to the military and naval commanders at Manila for the capture of the Philippines.

The Cuba Submarine Telegraph company is an English corporation, and in a recent note to the stockholders the secretary makes this statement: "I am instructed to inform you that, owing to the war in Cuba, which has prevented the returns being sent home, it will not be possible to make up the accounts for the half-year to June 30th for presentation to the shareholders at the usual time, and the meeting will, therefore, be postponed until later in the year, due notice of which will be given to the shareholders. The directors regret to state that the operations of the war have caused considerable damage to the company's cables and property, but they are unable at present to estimate the extent thereof."

General Greely announces that the censorship of telegrams is practically abolished. He has sent this notice to the telegraph companies: "Censorship is raised on all commercial, code or cipher dispatches to and from Cuba, Porto Rico and all West Indian islands. In addition arrangements have been made with the Spanish government authorities whereby they agree to abolish similar restrictions on code messages in Cuba. As the Spanish still exercise censorship over press messages and over private telegrams containing statements injurious to the interests of Spain, similar action will be taken regarding like messages in the United States, but the censorship will be of the most liberal character."

How Carbons Are Dutiable.

[From the Washington correspondent of the Western Electrician.]

On the 3d of September last and to the 11th of October, importations were made by R. F. Downing & Co. and Hugo Reisinger of carbons, which were imported in lengths of 24, 29 and 36 inches each. These carbon sticks were classified in accordance with instructions issued by the Treasury Department on October 27th of last year, which were in the main as follows: "In order to reach an authorized decision on the subject, you are hereby directed to classify such carbons at the rate of 90 cents per hundred, according to the commercial length which existed at the time of the tariff act of July 24, 1897, so that sticks of carbon 36 inches in length would be chargeable with duty as consisting of three carbons of 12 inches each, and other lengths in proportion." The wording of paragraph 98, under which the carbons were assessed, reads "* * * carbons for electric lighting, 90 cents per hundred."

Thus the collector divided these sticks into lengths of 12 inches each and assessed each of these dividends and fractional parts thereof as a separate carbon suitable for electric lighting, at the rate of 90 cents per hundred. The matter was carried before the Board of General Appraisers, and the importers, at the hearing, contended that the carbon was either dutiable under the provision of paragraph 97, as "carbon are not specially provided for in this act, * * * 35 per centum ad valorem," or else under paragraph 98, as quoted above, and that the mental process of cutting up these articles as adopted by the collector, so as to increase their number for dutiable purposes, was unauthorized by law.

There was no controversy as to the fact that these carbons are articles composed of carbon and that they are not decorated in any manner, as further provided for in paragraph 97. It follows therefore that they must be classified and assessed as such for duty under paragraph 97, of said act, unless they are more specifically provided for elsewhere in the same act.

The contention of the importers was that they were specially provided for under paragraph 98, as "carbons for electric lighting," and were dutiable as such at 90 cents per hundred, without regard to any question of lengths.

On the other hand, the government contended that, while they were not in their imported condition, "carbons for electric lighting," of the commercial character and length commonly imported and known as such on and prior to July 24, 1897, they can be mentally divided into lengths of 12 inches or less, and made dutiable in these reduced lengths by the hundred, at the rate named.

The Board of General Appraisers found the following as facts:

1. The goods consisted of sticks or rods of carbon, imported in lengths respectively of 36, 29 and 24 inches.

2. The articles are not suitable, or capable of being used for, electric lighting in the lengths and condition in which they are imported; but, in order to adapt them for such use, it is necessary to cut them up into shorter lengths, to point some of them and smooth or grind the ends of others.

3. Prior to July 24, 1897, carbons of these lengths were not imported into this country. They were then imported commonly in lengths varying from 4½ to 14 inches long, and occasionally as long as 16 and perhaps 20 inches.

The mere fact that, at the date of the passage of the act, the goods had not been manufactured or imported "does not withdraw them from the class to which they belong when the language clearly includes them." (Smith v. Field, 105 U. S., 52.)

There is much force in the argument that, inasmuch as the ultimate use of these carbons is for electric lighting, and that the language of the tariff act affixes no limitation of length to them, they should be classified under said paragraph 98, as "carbons for electric lighting," under the principle settled by the Supreme Court in the hat-trimming cases. But in view of the vigorous dissenting opinion in those cases, and some manifest points of difference between the merchandise there involved and that here in question, we do not feel authorized to depart from the rule, so well established, that duty is to be assessed upon imported articles in the state or condition in which they were imported. (Paturel v. Robertson, 41 Fed. R., 329.)

The board stated that this rule not only, in its judgment, excludes the articles from classification under said paragraph 98, but it equally prohibits customs officers from mentally dividing them up into shorter lengths and making other suppositious changes, so as to force the article within tariff terms not otherwise describing them.

The protests claiming the merchandise to be dutiable at 35 per cent. ad valorem, under paragraph 97 of said act, as articles composed of carbon, were sustained and the collector's decision reversed. The other claims in the protests were overruled.

Canon City-Cripple Creek Power Transmission Plant.

At noon on August 17th Governor Alva Adams pressed the button which was the means of putting in motion the massive machinery of the Colorado Electric Power company at Canon City, Colo. The electric current was transmitted to the Cripple Creek gold mines, 24 miles distant, where arrangements had been made to substitute electric motors for the steam-power equipment that has heretofore been in use. This means the successful accomplishment of another big undertaking which adds to Cripple Creek's greatness as the foremost gold-producing camp in the United States, and at the same time records another instance where electricity was considered as the model power for mining purposes by a community of practical men. The occasion attracted to the scene 400 prominent mine owners from Colorado and other parts of the country. After a thorough inspection of the plant had been made, the visiting mining men were entertained and Governor Adams delivered an address.

It is proposed to generate electricity at Canon City, which is in the midst of extensive coal fields, and transmit the power to Cripple Creek, where coal commands a high price. This will enable mines to be operated at a profit that have heretofore had a struggle to make expenses, and at the same time effect a very great saving in running expenses with the large producers. This promises to be a very important point in the future development of the camp.

The plant is one of the largest and best equipped electric-power installations in the West. The equipment consists of three Hamilton-Corliss engines with a combined capacity of 9,000 horse power, direct-connected to three Westinghouse three-phase generators of 2,100 kilowatts capacity, wound for 500 volts, making three separate generating units, one of which will always be held as a reserve in case of an emergency. For exciting the fields of the main dynamos there are two "Kodak" exciter outfits, each of which is capable of exciting all three of the main dynamos. One of these will be an emergency machine.

The engines are supplied from a battery of Heine safety-tube boilers, and the exhaust steam is taken care of in a surface condenser. The air and circulating pumps and feed pumps are all of the Snow make.

There have been installed at the main station four step-up transformers to raise the potential from 500 to 20,000 volts, at which pressure the current is delivered to the transmission line. The first sub-station is near Victor, on the saddle between Battle Mountain and Bull Hill. The location of the second sub-station is on the saddle between Gold Hill and Globe Hill, near Cripple Creek. At each of the sub-stations the current is again transformed by step-down converters to 500 volts, at which pressure it is delivered to the motors in the mines.

In addition, lights are to be supplied from the same wires used to furnish power. One of the prominent features in the construction of this plant is the insuring of continuous service; the machinery and construction are of the very best, and ample reserve capacity is carried throughout. The construction of the transmission line is most substantial, and particular pains have been taken in protecting it from lightning. In addition to the lightning arresters in the generating station at Canon City and in the sub-stations, lightning arresters have been installed at a number of points along the transmission line.

It should be added that in addition to the 24 miles of line between Canon City and Cripple Creek, there is about six miles of line over the camp, which will make the total length of the system about 30 miles. The work of constructing this system was commenced last September.

The entire line is patrolled by experienced linemen; they carry with them a telephone epecially adapted for their work, which they can connect with the main line at any point and send in word wherever they find a break. Western Union call boxes are stationed along the line and through them the patrolman must report where he is every hour.

The main station of the Colorado electric-power plant is a substantial structure 140 by 106 feet, constructed of brick, stone and cement, with steel trusses and corrugated iron roofing. Allowance has been made so that the entire plant can be duplicated without the addition of another smokestack or extra condensers.

This plant has cost not less than $750,000. The company is composed of John D. Rockefeller, Andrew Carnegie and Westinghouse interests.

The transmission line was erected under the supervision of the Mountain Electric company of Denver. It used a specially designed insulator. The generating apparatus was installed by the Westinghouse company and the steam equipment was put in under the supervision of the Stearns-Rogers company in Denver.

It has been carefully computed that there will be a saving of 25 per cent. in the operating expenses of the mines if electricity is substituted for steam in hoisting the ore, running drills and similar work.

The interurban line between Chippewa Falls and Eau Claire, Wis., is promised to be in operation by September 1st.

Interesting Storage-battery Discussion.

PART I.

On June 4th Mr. Joseph Appleton, the chief engineer of the Electric Storage Battery company, read a paper on "Recent Developments in the Applications of Storage Batteries" before the Engineers' Club of Philadelphia. He covered the subject thoroughly, and, did space permit, the Western Electrician would gladly reprint his paper. As it is, room can only be found for the interesting discussion which followed. This is especially noteworthy from Mr. Gibbs' statement of the policy of his company in relation to the cost of storage batteries. The discussion, as given in the official proceedings of the club, is as follows:

Charles Hewitt: I do not suppose any intelligent engineer to-day will deny that the storage battery is a good thing. Yet Mr. Appleton has said that only a few years ago no engineer who recommended a battery would be considered anything else but a crank. Granted that improvements have been made in the plates and cells, the battery is the same to-day that it was many years ago—I do not know how many, but 10 to 15 possibly. It is pertinent to ask why we Americans have been so slow to appreciate a good thing. Does the fault lie with us, or does it lie with the manufacturers of the battery? European engineers have been using the storage battery very extensively for a number of years in places where they have not been used in this country, except for the last two or three years. I refer to batteries in central stations. It was almost exceptional in Europe to go into any station without finding an auxiliary battery I ask again why it is we have been so slow, and, in thinking the matter over, it reduces itself to three reasons. In the first place the manufacturers of storage batteries, in the early days in this country, attempted to use them in places where they were ill adapted to such an extent and with such failures, electrically and financially, that engineers were afraid to recommend them. That is one reason why an engineer would be considered a crank. He did not dare recommend it, as it had gone throughout the country as a failure. Another thing has been the excessive litigation which has gone on during a number of years. Happily, this litigation has been settled, and the battery is now upon a legitimate business basis. The third and perhaps most potent reason at the present day is the cost of the battery. Mr. Appleton has said very little about this. He has stated that we can reduce the size of our generating units one-third, and possibly one-half, but the portion that we reduce we replace with a battery which costs 50 per cent. more than the generating unit. I may be taken to task for that, but at the same time I believe it is a fair statement. The storage-battery people estimate the output of their battery very liberally, much more than a user finds he can obtain from it for a long run—I mean by the time it is several years old. An engineer from abroad —I think he was an Austrian—made the statement recently that the batteries abroad cost one-third of what they do in this country. I do not know whether that is true; perhaps Mr. Appleton does. At any rate, I know that the batteries sold abroad are much cheaper than those sold in this country per kilowatt-hour output. When these reasons are properly understood, I believe the statements made as to the engineer being a crank can be appreciated. At the same time there is no litigation of any kind on hand now, and batteries can be used for what they are adapted for, and engineers can use them without being considered cranks.

Henry G. Morris: It is certainly very satisfactory to those of us who have been pioneers in the introduction of storage batteries to find that the industry has reached the stage of development as indicated by the figures given by Mr. Appleton, even if we have met the usual fate of pioneers.

The subject of the propulsion of vehicles by means of storage batteries is one in which I have been interested with Mr. Salom, and I would ask him to give you some figures relating thereto in supplement of those given by Mr. Appleton.

Pedro G. Salom: I did not bring any figures with me this evening, and Mr. Appleton has covered the subject so exhaustively in his admirable paper that there is really very little to add. There is one statement of interest, however, that he did not make, and that is that the 12 electric hansoms and one electric brougham in New York have made over 50,000 miles, from April 1, 1897, to the present time (about 14 months), although we did not get them all into actual service until September, 1897.

These vehicles were the first of their types ever constructed, and there was no data to guide us beyond our experience with the first two vehicles which we constructed, of radically different types. We were compelled to put them into actual public service in competition with vehicles drawn by horses, and without a chance to correct obvious defects or rearrange gearing or parts, and yet, notwithstanding these unfavorable conditions, they have average nearly 4,000 miles each. This is an extraordinary performance, and must remove whatever doubts may exist as to the practicability of motor vehicles. I do not believe that the first 12 trolley cars can show such a record.

The average mileage of vehicles is very much overestimated.

We have endeavored to gather statistics on this matter, and I think it would be a fair statement to make that few vehicles [illegible] a day. In exceptional cases, such as [illegible] living in the country, the above average may be materially exceeded. Ordinary delivery wagons, or other vehicles of that nature, do not average over 15 miles, and when compelled to make a greater mileage they must use an additional horse. The vehicles of the Pennsylvania railroad at their Twenty-third street ferry make about 28 miles a day with two horses, 14 miles for each horse, and as that is the cheapest cab service that has ever been given in New York it is probable they are doing a larger mileage than any other cab service ever before instituted; so that it is a fair criterion on which to base calculations for the future. There is a great deal of foolish criticism in regard to electric vehicles. One point made is that they cannot go from here to New York, or a similar distance. If they can go 25 miles per day on one charge, which they are doing now, we think all the requirements of cab service will be thoroughly covered and met; and, if it is necessary, after they have made that mileage, and the system is once generally introduced, there will be other stations where the batteries can be changed or recharged, and that will remove the only valid criticism raised against the introduction of the system which exists, as it will be undoubtedly much cheaper than the present system with horses. The actual amount of power required for a 25-mile drive is about 12 horse power hours, and we pay for that about three cents per horse power per hour, and with a larger station we can probably get it for less. That makes a very small figure for the cost per mile, and especially so when the large rates received for cab service are considered.

E. M. Nichols: I understand that it costs about 36 cents for 12 horse power hours.

Mr. Salom: Yes; that is the amount sufficient to run the machine 25 miles. In other words, you can ride 25 miles for 36 cents' worth of power.

Mr. Spalding: The "common" storage battery first installed at the central office, to replace the two primary cells at each subscriber's instrument used for talking, has completely revolutionized the system of signaling, so that now the subscriber, instead of ringing a bell and operating a magnetic signal at the office, simply takes his telephone off the hook, by which a lamp is lighted in front of the proper operator. The same general system of signaling is also now used on the cords connecting two subscribers' lines, and the condition of the lamps, whether burning or not, indicates to the operator whether the subscribers are still talking or have finished, so that the connection can be taken down.

Two styles of lamps (four-volt and 20-volt) are used. The higher voltage of the battery, while charging, would materially lessen the life of the four-volt lamp. Two separate batteries are installed, and one is charged while the other is discharged. For the 20-volt lamps, which are not so delicate, but one battery of 10 or 11 cells is employed, with a switch so arranged that 10 cells are used for the lamps when the battery is charging and 11 cells when it is discharging. The voltage at the lamp terminals is thus kept practically constant.

This change to automatic signaling throughout is really more important, as far as increased quickness and efficiency of service is concerned, than the actual saving in dollars and cents by the use of storage batteries in place of primary cells for talking.

Mr. Appleton: I would like to make a reply to Mr. Hewitt's remarks. First, in regard to the difference in cost of batteries in this country and Europe; you must take into consideration the cost of materials and labor, which are big items and which are much higher than in Europe. Mr. Hewitt states that the cost of the batteries in this country is 50 per cent. greater than the generators they would replace. I do not think if that was the case there would be any battery installations made.

Mr. Hewitt: I said a complete steam plant and generators.

Mr. Appleton: I refer to that too. If the peak which the battery has to carry has a wide base, and of three or four hours' duration, this would make the cost of the battery excessive, and bring the battery up higher than the generator. Take, for example, the case I mentioned in which 50 per cent. of the investment in generating plant and underground mains was only used for 154 hours during the year. For loads of that description the base of the peak is never more than one hour or one hour and a quarter, and at that basis there is no doubt that the storage battery is very much cheaper than the complete steam plant. In regard to the question of costs: In Chicago, where they are figuring on the prepayment system, I believe they will charge 25 per cent. for two kilowatt-hours. That is, of course, double or nearly three times what would be the cost to generate in a large station, as described in New York. But where it is supplied as a matter of convenience, they expect to charge the higher price.

Mr. Hewitt: I did not intend for one moment to question the decreased cost of operation of a station by using storage batteries or the battery's facility for accommodating itself to the load. I know only too well, in my experience in this city, the value of such a battery. What I meant was that if we were building a steam plant of the best type, with condensing engines to cost about $85 per horse power, the battery necessary would cost nearly $120 per horse power, which is about the first-cost ratio per kilowatt output. As to the operating cost I do not doubt [illegible] that it would pay in many cases to [illegible] cost, in order to reduce the operating expense. I personally think any water-power plant is incomplete without a battery plant. It could never realize the full economy of the water wheels without this auxiliary; and I also believe that most, if not all, of the railway plants would be benefited by auxiliary batteries in their operating cost. But I still maintain that as to the first cost, output for output, the battery is much more expensive than generating units.

Standard Diagrams of Electrical Apparatus.

A criticism of the conventional electrical diagrams adopted by the Chicago Electrical association appeared in the Telegraph Age of last week and was submitted to Mr. T. G. Grier, the chairman of the committee that prepared the drawings. The Age's article was written from the point of view of a student of telegraphy by Mr. W. A. Van Orden, who claimed that the symbols of the association for telegraph apparatus go too far in the direction of simplicity, not conveying to the mind a mental picture of the object described. The writer also advanced the very curious argument that the designs were not pretty enough for "periodicals like the Telegraph Age." Tasteful diagrams, he says, render a page conspicuous and attractive, but "the new style of diagram would not only rob the artict of his opportunity to exhibit his skill, but the severe hard outline drawings deprive the publisher of that conspicuous display which is part of his stock in trade."

Mr. Van Orden's critique is not of the greatest importance, perhaps, but in commenting upon it Mr. Grier states concisely the value of conventional symbols to engineers, inventors, students and draughtsmen.

"The article taken from the Telegraph Age of August 6th, entitled 'Uniform Drawings,'" says Mr. Grier, "which is a criticism of the standard diagrams of the Chicago Electrical association, has been written without a clear comprehension of the subject.

"Diagrams have been used by engineers for years as a means of simplifying work. They are a code language and have differed in details, but always have one aim in view, that of lessening the work of illustrating ideas. The author of 'Uniform Drawings' searched through this collection of symbols [the pamphlet on standard diagrams] for a new and improved method of delineating telegraphic apparatus. He seemed to think that in this collection of symbols he would find pictures. He demands for the enlightenment of students and for the columns of periodicals like the Telegraph Age diagrams that show at once an artistic picture of the device. He keeps in mind the student of telegraphy and the artist's lost opportunity to display his skill.

"The object of the Chicago Electrical association was not to present a series of pictures of devices, but to collect and standardize the shorthand language of the engineer and draughtsman. The symbols of a science are not to be grasped at a glance; they are the skeletons, the outlines of the thought; they represent a principle and not a specific design. Designs and forms of devices may change and multiply, but the principle remains the same. It is the principle that is represented. The diagram may be wholly or partially arbitrary in its selection, and yet be more admirable for its purpose than any drawing of any particular form of device could be. Shading or any elaboration of diagrams increases the difficulty of drawing and destroys the simplicity—a great value when general uniformity is desired."

Electrical Novelties for the West Indies.

The New York Tribune obtained the opinion of several export brokers on the subject of the demand for American goods in the new island territories of the United States. One interview was with C. E. Stevens, who, with F. O. Prescott, is in charge of the Edison Electrical Novelty agency at No. 44 Broad street. "The Latin race," said he "spends money lavishly on luxuries and novelties, both in matters of dress and pleasure. When better banking facilities are secured, and particularly when responsible houses here in New York will undertake to negotiate shipping documents, the present conditions will be greatly improved. We find a ready sale in all sorts of electrical novelties in both the West and East Indies, and expect to do a large business, particularly in projectoscopes and films. I reason, by analogy, that all sorts of ornamental articles of attire, fancy headgear, mechanical toys and musical boxes, and, in fact, anything that will touch upon the love of color and pleasure of the tropical peoples, will prove to be profitable articles of export, more so, perhaps, than staple goods. There is a good deal of money on the islands, and it is much more generally distributed than is supposed. The people are not educated up to investing their surplus in agricultural implements. They save it until they find a chance to spend it for some sort of alluring trifle or on personal decoration. We expect to push our goods briskly, both by advertising and through personal canvass by our agents."

Mr. Boyle's Work in Willmar.

By reading attentively the account of the electric-light plant in Willmar, Minn., prepared by Christian Johnson, the president of the village council, and published in the Willmar Tribune, the disinterested outsider will be greatly edified and will conclude that some of the bright minds in the electrical business are contributing to the success of the Warren Electric Manufacturing company. It seems, to tell the story briefly, that the village of Willmar purchased an alternator from the Warren company some time ago. But it was claimed that the machine was detective, and, after some correspondence with the maker, an exchange was effected, a new machine being supplied for the old one. This, too, gave trouble. It ran hot in the bearings, and the local electrician said that the fault was with the dynamo. A resolution was adopted by the village council notifying the Warren company to send a man to Willmar to remedy the defect. If this demand was unheeded, the village would employ an expert dynamo doctor and charge his fee to the Warren company.

Up to this time the villagers were chipper and "sassy" and having everything their own way. The village recorder, in transmitting the resolution of the council, expressed the hope that the company would neglect the matter no longer. The company acted on the hint and gave immediate attention to the complaint in a letter written by C. C. Warren. Now, Mr. Warren is not without experience in selling electrical machinery, and he knows how to express himself in the English language. So it was no trouble to unlimber some of his light artillery in the direction of Willmar. "Someone has undoubtedly done some fool thing that has occasioned what little annoyance you claim to have had," he wrote; and "A set of men who are so short-sighted as to pass such a resolution exhausts our patience," was another of his declarations. Mr. Warren said that the first machine was all right and that he knew the second must be also. The company's patience was exhausted, and were it not that a man had started for Willmar before the recorder's letter was received, none would have been sent. As it was, the company expected that the village would pay the expenses of the expert's visit.

Such was the situation that confronted Mr. James M. Boyle, E. E., of the Warren company when he arrived in Willmar. And what did Boyle do? Well, he did several things, as shown by his report to the president of the village council. He first found that the dynamo and exciter were running in excellent shape, as far as their electrical and mechanical qualities were concerned. Then he made some suggestions as to belting, lubrication and the like; said that the station men need not hesitate to overload the machine, and that he had made a change in the wiring circuit of the exciter which practically obviated the danger of demagnetization, which had existed before. He sold to the chairman of the electric-light committee (the man who had introduced the resolution of instructions to the Warren company) an extra field coil for the alternator and jauntily attached the bill to the report. With the village electrician he had tested the machine, and the two had jointly ascertained that "the machine has a remarkable electrical efficiency, approaching 99 per cent. at about half load." If the changes he had suggested were made and the new field coil provided, Mr. Boyle was sure that excellent and constant service might be expected from the Warren alternator.

Mr. Boyle's report opened the eyes of the councilmen to the real treasure they had in the Warren machine. A special meeting was called; the village electrician testified that the dynamo was all right and that the manner of running it was alone at fault. Mr. Johnson, the president of the council, made a public statement, possibly at Mr. Boyle's suggestion, "to silence the rumor afloat that the Warren dynamo is not an efficient machine," and gave his opinion that they had indeed a remarkably efficient machine. At last the truth triumphed in Willmar.

Mr. James M. Boyle, E. E., seems to have chosen well his vocation.

Detroit Lamp Contract.

The Detroit correspondent of the Western Electrician sends the following account of a transaction in that city: "The General Electric company and the Adams-Bagnall Electric company have a warm fight on in this city to see which firm will have the honor of furnishing the city 100 arc lights. At the last meeting of the public lighting commission bids were opened from these two companies. The General Electric company offered the lamps at $20 each, and the Adams-Bagnall Electric company made a bid of $17.25. The bids were referred to City Electrician Steele for a report on the relative value of the lamps, and at the meeting of the commission Monday night [August 15th] Mr. Steele submitted his report, stating that the two lamps were of equal value. In the meantime the bids had been published in the local papers and each company saw what the other had bid. The agent of theAdams-Bagnall company made no attempt to do anything further about it, but J. H. Livsey, representing the General Electric company, appeared at the meeting and offered his lamps at 25 cents per lamp cheaper than the bid of the other company. The commission would not accept this, but offered to reject the former bids and advertise for new ones, provided his offer of $17 per lamp held good if the new bids were rejected. This offer was accepted and new bids for the lamps will be advertised. Mr. Livsey states that all the lamps in the city at present were furnished by his company, and he wanted to secure the contract on account of the advertisement it would prove for his company. He asked that his offer be suppressed in the daily newspapers, but the commissioners would not assent to his request."

CORRESPONDENCE.

New York Notes.

New York, August 22.—The problem of transportation over the East River bridge is still of pressing importance. The elevated and surface railroads now carry an average of 210,000 people a day, while the old bridge trains formerly carried only from 110,000 to 120,000 people. Much of this increase is made up of people who formerly used the ferries or walked, but who now ride over the bridge for no additional fare. People have stopped using the ferries in large numbers and many have stopped walking over the bridge. They now go from Brooklyn to Manhattan for a five-cent fare, while by ferry routes they paid six cents in commutation hours or by the bridge they paid seven and a half cents in all. It is evident that the bridge is overcrowded during the rush hours, and relief must be sought in some direction, even after all reasonable precautions for safety have been taken. The building of a new bridge exclusively for the use of the transportation companies has been suggested. In a recent interview Clinton L. Rossiter, president of the Brooklyn Heights Railroad company, said: "The surface railroad companies of this borough would be willing to sign a contract to the effect that they would pay the interest on $5,000,000 of the money put into the construction of an all-railroad bridge, in return for privileges of crossing the structure. I am heartily in favor of another bridge, and concur in the opinion that the necessity for additional means of communication between Brooklyn and Manhattan is every day becoming more pressing. The suggestion has been made that the railroads themselves should build this bridge. It has been said that it is their place and duty, but I do not agree with this, and frankly confess that the company which I represent has not the money necessary to be expended in such a large undertaking, and I do not think the other railroads of this borough are able to make such an outlay of capital." Mr. Rossiter estimated that an all-railroad bridge would cost about $10,000,000, and if the elevated railroad companies would pay the interest on the other $5,000,000, the bridge, he said, would practically cost the city nothing.

The property-owners on Amsterdam avenue who object to four tracks on that thoroughfare are still active. A committee called at the mayor's office on Tuesday in relation to the matter. The fight between the property-owners and the railroad companies has been going on in the courts for some time. One set of electric railway tracks is now in operation by the Metropolitan Street Railway company, and a second set, owned by the Third Avenue company, is laid on the avenue, and on these the Third Avenue company purposes running electric motor cars. The property-owners say that one set of tracks is enough; that the four tracks take up more than half the width of the avenue, and that the lives of school children will be endangered. The Third Avenue company, having received permission from the railroad commissioners to change its motive power from horse to electricity, sought permission from the city authorities last year to tear up the avenue. Against this the property-owners protested, and the commissioner of public works of the old city refused the request. Suit was brought, and an alternative writ of mandamus was secured from Justice Russell. The case is now pending before the Court of Appeals, and it was to ask the mayor to have the corporation counsel make a vigorous defense that the committee called.

Negotiations are in progress between the Brooklyn Elevated Railroad company and the Brooklyn Heights Railroad company, looking to a traffic agreement by which the former will be able to operate its cars on the new trolley routes to Bensonhurst and Bath Beach. The plan is to have the Heights road continue its Avenue C routes across the Ocean Parkway and down Sixteenth street to the Eighty-sixth street line and thence through to Bath Beach and Bensonhurst, the elevated road making a connection by means of an inclined plane at Thirty-sixth street.

James Schofield of Lowell, Mass., a lineman employed by the New York Telephone company, narrowly escaped death from a live wire at White Plains. He was joining two cables for connecting the new telephone exchange with the new wires being strung. On the pole on which Schofield was working three large feed wires to supply power to the trolley road are hung. In some manner the cable, which is lead covered, struck against the feed wire at a spot where the insulation was worn off, and instantly the man received the full current through his body. Schofield was unable to let go his hold of the cable, and the current passed through him until a man on a bicycle rode to the power house and had the current shut off. When this was done Schofield fell back on the little platform upon which he was working and laid there unconscious for 15 minutes, when he was removed to a drug store, where he received medical attention. He revived under the treatment and was conveyed to his home. His hands and feet were severely burned, and a large hole was burned in the cable. M. S.

Northwestern Notations.

Minneapolis, August 20.—A motor wagon is to be tested between Pierre, S. D., and Rapid City. The wagon is expected to make the trip in 10 to 12 hours.

J. H. Rafferty, the promoter of the Waterloo and Cedar Falls Electric railway system, died at his home in Waterloo, Ia., recently, after a brief illness.

The County Board of Equalization in St. Paul treated the Twin City Rapid Transit company very tenderly in its recent session. The company's assessed valuation was reduced $900,000, leaving it $701,000. The change was made in executive session, at the closing meeting of the board, and seems to have been railroaded through. The assessment of last year is being fought in the courts by the company, and it is thought that the board sought to placate the company by reducing its valuation this year.

A foreclosure of a mechanic's lien has been begun against the Waterloo and Cedar Falls Rapid Transit company at Waterloo, Ia. It is believed that none of the creditors will lose anything, as the company has no large unsecured debts.

The Waupaca Electric Light and Railway company of Waupaca, Wis., has filed a trust deed to the Milwaukee Trust company for $42,000, to secure the payment of that amount of bonds. The company will push the construction of the road as rapidly as possible.

The city of Eau Claire, Wis., is taking bids until 2 p. m., September 7th, for lighting the streets of the city for a period of two, three, four and five years with electricity or gas.

The council of Mitchell, S. D., ordered the Mitchell Electric Light company to have the plant in running order within 60 days from June 6th. The company failed to do so and the council voted to annul the franchise. The council will endeavor to secure better figures for lighting before giving a new franchise. The plant was burned last May and the company has not completed rebuilding it.

The street-railway company at Fort Dodge, Ia., is at outs with the council as to a track across the public square. The council has carried the matter into court and was prepared to take further steps when the street-railway company countered with an injunction preventing the council from interfering with the construction of the track. The company then went ahead and laid the track and will be in position to operate the line before the court hands down its decision.

The railway and light company of Winona, Minn., is substituting for its series arc lights incandescent arcs, operated on incandescent circuits. C.

Canadian Intelligence.

Ottawa, Ont., August 20.—The West Kootenay Power and Light company has closed a contract with the Canadian Pacific railway to supply electric current to operate the latter company's smelter at Trail.

The city of New Westminster, B. C., is resisting the proposal of a company to tap the waters of the Coquitlan Lake and develop electric power. The civic authorities believe that the city needs all the water supply over which it has rights of user as a reservoir.

The Ottawa Electric company has supplied its employes whose duty it is to read meters with a portable electric light worked on the storage-battery system. The light is five candle power, and will run continuously for 12 hours without change of battery. The article may be readily carried in the coat pocket.

Ten months' earnings of the Montreal electric street railway amount to $1,179,284.63. For the same period last year the earnings of the railway were about $100,000 less. During the month just closed the figures are unprecedented, over $144,000 having been collected, an increase of about $15,000 over the corresponding month last year.

It is reported that the Ottawa Electric Railway company is negotating for the purchase of the Gatineau Valley railway, and will convert that road from steam to an electric railroad. The country through which this line passes is of the grandest in Canada, and it is in the Gatineau Valley that the famous fishing grounds are situated.

Nelson Moore of Guelph, Ont., has completed a model of his overhead electric railway. The hardwood posts from which the cars are suspended, as well as the base and arms, are encased in steel and strongly riveted to prevent vibration. Two iron sockets are suspended from the arms of the post and into these steel rails are laid. The wheels of the car are built after the manner of bicycle wheels, with steel spokes and ball bearings, which give strength and lightness and ease of motion. The framework of the car will be of strong iron or steel, and the car is suspended from the wheels to a distance of three feet from the ground. The interior is fitted with back-to-back seats, which run the entire length through the middle and are suspended from the top. The inventor claims many advantages for his overhead road. No grading or ground work has to be done in constructing the road; no bridges are required to span streams or cross ditches

and ravines—a material consideration. Then, in the winter-time, there would be no cleaning away of snow from the track and, for the same reason, no washouts. Mr. Moore claims that less electric power would be required to operate the cars in comparison with the present system, that greater speed would be obtained and more effective locomotion secured.

Ottawa, August 13.—The Imperial Privy Council has refused to grant the Toronto Street Railway company leave to appeal from the decision of the Ontario Appeal Court, which upheld the right of Toronto to assess rails, poles, etc.

Another application will be made at the next session of Dominion Parliament for a charter for a bridge between the city of Hull and Ottawa to give the Hull and Aylmer electric railway entrance to Ottawa. A vigorous lobby defeated the bill at the last session of Parliament.

The Jacques Cartier Water Power company of Quebec has been organized with the authorized capital stock of half a million dollars. The company has acquired from the Standard Light and Power company of Montreal its chartered rights to introduce electricity for light, power and heating throughout the city of Quebec. It is expected that the company will have the work in full operation on or before the first day of January next.

The Montreal Park and Island Railway company has been refused the right to appeal to the Privy Council from the judgment of the Court of Appeal for the province of Quebec. The company entered into a contract with the town of St. Louis du Mile End some years ago, by which it was to supply the town with a first-class electric-car service on the principal streets, with transfers to the Montreal street railway. The company failed to carry out its contract, and the corporation took out an action against it and prevailed.

The Ottawa City Council has passed the Metropolitan Electric company's by-law, which lets in a new electric corporation to operate in Ottawa. The by-law provides among other things that the company is not to charge for incandescent lighting more than one cent per ampere-hour, with a discount of 40 per cent. and a further discount of 12 per cent. for cash within 15 days, off the lowest meter price. At the expiration of 10 years the city has a right to acquire the property of the company at its actual cash value. The company has made arrangements for obtaining its water power at the Chaudiere Falls and has already secured over 2,000 horse power to begin with, and an option for 5,000 more if needed.

It is reported that the Toronto Electric Railway company has entered a suit against the Siemens & Halske Electric company of Chicago for $25,000 for breach of warranty of a generator.

The shareholders of the Montreal Island belt-line railway have authorized the directors of that company to issue new bonds to the extent of $380,000 and to cancel and redeem the old issue of $300,000.

The ratepayers of the city of Hamilton, Ont., have voted in favor of extending the franchise of the Hamilton Street Railway company for a further period of 15 years, or until the year 1928. The vote was strongly against the corporation in the proposition to assume control of the street railway.

The trouble between the Ottawa Electric Street Railway company and its employes is reaching the acute stage. The company has already dismissed a number of its conductors for various reasons, but chiefly, it is said, because they belong to the union. The employes propose to appeal to the public of the city in order to enlist active popular sympathy on their behalf. The employes are asking for a 10-hour day and the wage of $1.50; they are now offered $1.43.

Professor Callendar, recently of the staff of McGill University, Montreal, has designed a platinum electrical-resistance thermometer, capable of measuring temperature to the ten-thousandth part of a degree. The extreme delicacy of the instrument makes it a valuable aid in securing accurate observations of the temperature of lake and river water during the various seasons of the year, as no other thermometer is available for such minute measurements. W.

PERSONAL.

Carl Moderegger, chief engineer for Siemens & Halske at Vienna, Austria, is visiting this country to make a close study of electric street-railway systems.

A party of representatives of the Russian army and navy visited Schenectady recently. The visitors called at the General Electric company's works and were shown through the various departments.

According to a cable dispatch from London under date of August 21st, "the personal estate of the late Dr. Cornelius Herz, who, it was charged, was implicated in the Panama Canal scandal, has been sworn to at £20." Dr. Herz was considered a very wealthy man during his life.

Mrs. Catherine Richardson Barton, wife of Enos M. Barton, president of the Western Electric company, died on Thursday morning, August 18th, at the Milwaukee sanitarium, where she had spent some months for the benefit of her health. Mrs. Barton was the daughter of Professor John F. Richardson, formerly professor of Latin in the University of Rochester. Three children survive her—a son, now senior in the University of Chicago; a daughter, member of the junior class in Bryn Mawr College, and a younger daughter at home. Mrs. J. S. Dickerson and Mrs. J. H. Lippincott of Newton Center, Mass., Mrs. W. C. Wilkinson of Chicago and Mrs. Spencer Dickerson of Evanston are sisters of the deceased. Twelve years ago Mr. and Mrs. Barton sustained the loss of a son by drowning, and the sudden bereavement had a profound effect on the health of the mother. She never entirely recovered from the shock, although surrounded by every attention, and it shortened her life. The immediate cause of death, however, was pneumonia. Mrs. Barton was a woman of notable character and intellect, and the members of the family will have the respectful sympathy of many friends in their grief.

ELECTRIC LIGHTING.

The city of Nelson, B. C., has resolved to purchase the Nelson electric-light plant under terms of purchase offered, which are $35,400.

The Washington Electric Light company, Washington, Pa., is increasing its plant by the addition of a 200 horse power Ball engine.

The Portland (Ore.) councilmen propose to take time by the forelock by beginning at once to arrange for the lighting of the city for two years from April 1, 1899, when the present contract expires. Outside companies that may offer to erect a plant will have time to do so.

ELECTRIC RAILWAYS.

A recent blaze on the Alley "L" structure in Chicago was caused by a spark from the contact rail igniting gas from a pipe accidentally damaged by a workman. The ties caught fire and the firemen were called out. Traffic was suspended for 20 minutes.

The Los Angeles (Cal.) Traction company is building an extension to Boyle Heights, and a line to San Pedro is proposed. The company is installing a new 500-kilowatt generating unit, consisting of a Hamilton-Corliss engine and a Walker generator.

The Honolulu Commercial Advertiser says that the Hawaiian Tramways company proposes to convert its mule line to one electrically operated. It asks for the right to have double tracks on King street from Thomas Square to Waikiki, and on Beretania street from Punchbowl street to Punahou. Application has been made to the cabinet.

The San Francisco Chronicle says that it is rumored that the Southern Pacific Railroad company intends soon to substitute electricity for steam as a motive power on its entire local system. The change will, it is said, include the broad and narrow gauge Alameda "locals," the Seventh street, Webster street and Berkeley "locals" and the San Pablo avenue cable system.

The Union County, N. J., Board of Freeholders has granted a franchise to ex-Congressman John Kean for a trolley road between Elizabeth and Plainfield for a sum of $250,000. In addition to the quarter of a million dollars in cash, ex-Congressman Kean agrees to pay four per cent. interest on any amount in excess of that figure it costs to improve the Union County boulevard, which work the county will undertake on the strength of the $250,000 received for the franchise.

Arrangements are being made for a connection between the South Side elevated and the Calumet electric at Sixty-third street and Stony Island avenue, Chicago. The line of the latter road is to be extended a block north to that point, and two large elevators will be built to carry the passengers from the surface to the elevated-railroad platform. The capacity of the elevators will be 60 passengers each, and the cost of their construction will be in the neighborhood of $6,000. It is expected to have the connection completed by early fall. The Calumet electric people are counting upon a large increase in the traffic of their road as soon as these plans are carried out.

TELEGRAPH.

Recent advices from New Zealand state that the premier has informed the Assembly that he favors the Pacific cable, and unless a resolution was passed by the House to the contrary, he would adhere to the Pacific rather than to the Cape route. If Canada would come in New Zealand would also, and he believed Great Britain would help.

ELECTRICAL SECURITIES.

The Metropolitan Street Railway company of New York has declared a dividend of 1¼ per cent., payable October 15th.

The second quarterly report of the Nassau Electric Railroad company shows gross earnings of $570,959, as compared with $507,070 a year ago, and net earnings of $211,850. In fixed charges and operating expenses there has been a large increase.

The earnings of the Penn Electric company for the year, as reported at the annual meeting at Camden, N. J., was $4,250 from rental of the old party's circuits, and the balance on hand is $726.54. It was reported that the debenture debt amount to $19,123.42, having been reduced $8,592.51 during the year.

The July statement of the Edison Electric Illuminating company of New York shows gross earnings of $196,400.50, an increase of $33,947.02; net earnings $66,552.30, increase $7,517.80. For seven months the gross earnings were $1,738,123.46, an increase of $340,903.07, and net earnings $751,760.67, increase $121,011.05.

The stockholders of the General Electric company have voted to reduce the capital stock of the company, as recommended by the directors. The resolution presented by T. Jefferson Coolidge declared in favor of reducing the capital stock from the present amount to $20,827,200, of which 182,760 shares should be common stock of the par value of $100, and 25,512 shares of preferred stock of like par value. The present common and preferred stock and the number of shares of each holder will be reduced respectively to three-fifths of the face value.

MISCELLANEOUS.

A company of northern and southern capitalists was organized in Philadelphia last week to construct and operate telephone, electric-light and railway plants in the South. The main office will be at Atlanta, Ga. Mr. J. M. Wood of Wilmington, N. C., was elected general manager and purchasing agent. He can be addressed at Wilmington for the present. The company is said to have some valuable franchises. It is in the market for telephones, telephone supplies and electric-light supplies.

The Navy Department is inviting sealed proposals until August 30th, for two pairs of runways, erected on foundations in building No. 20, Brooklyn navy yard, together with lateral bracing and two electric traveling cranes of 20,000 pounds lifting capacity, with three motors each, for lifting and carrying with loads. Prospective bidders can obtain specifications and other information upon application to the Navy Pay Office at New York, or to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

An innovation has been inaugurated in Berlin, according to Elektrotechnischer Anzeiger. It appears that the city is divided into 15 sections with about 700 fire alarms. The latter are connected by underground cables with the central fire stations. Heretofore communication with the station from the alarm box necessitated the use of the telegraph key, which is fixed in each alarm box, and the observation of the needle of the galvanometer. Consequently a telegraph clerk had to be employed. Now each fire captain carries a small leather box, containing a microphone with switch, a second telephone, an induction coil, an automatic switch and a condenser and battery. He can now switch onto the alarm box and communicate with the superintendent, who sits at his desk at the central station.

TRADE NEWS.

The Dearborn Drug and Chemical Works of Chicago have recently analyzed 14 boiler feedwaters and shipped two carloads of suitable scale solvents to large sugar concerns in the Hawaiian Islands.

The Swett & Lewis company of Boston, dealer in X-ray apparatus, recently secured the contract for furnishing the X-ray outfit for the hospital ship Bay State. A 10-inch coil of special design was furnished. It will run from storage batteries; these batteries will be charged from the dynamo of the ship. Six of the type W tubes, manufactured by the company named, as well as a large fluoroscope, were furnished. The tube-stand was particularly adapted to this work. The main part of the stand and the base is of iron and very heavy; the arms holding the tube and wires are of fiber, with an adjustable wooden clamp for the tube. With this stand it is possible to hold the tube in any position from within a few inches of the floor to eight feet above it. The ship also carries about a gross of X-ray plates and a full developing and printing outfit. It is stated that the Swett & Lewis company is putting out a large number of static machines and has several large hospital orders on hand.

BUSINESS.

The Mason & Richards company of St. Louis has been organized by W. R. Mason and B. Richards to deal in electric-railway machinery and supplies The company is selling agent for the Walker company of Cleveland, Electric Railway Equipment company of Cincinnati, Keystone Electric company of Erie, Pa., Wagner Electric Manufacturing company of St. Louis and Forest City Electric company of Cleveland.

Mr. James Healey, who recently returned to Milwaukee from a trip through northern Illinois in the interest of the Julius Andrae & Sons company, states that the business conditions in the rural districts are very favorable. The splendid crops of the season have made it possible for the farmers to put in telephones and necessities in the electrical line. The company has secured the agency for the

famous Ericsson telephones in the Badger state. The Andraes say that these telephones are all that is claimed for them and that they are proving themselves beyond a doubt the standard of the world.

The estate of C. M. Robertson, Montville, Conn., recently lost by fire its boiler house. In order to obviate, if possible, a like experience in the future, the administrator has decided to put up a thoroughly fireproof construction in its place. The building will have steel framework, brick side walls, and an absolutely fireproof roof, consisting of corrugated iron covering laid on the Berlin Iron Bridge company's anti-condensation roof lining. Steel trusses will support the roof. The building is about 50 feet square, divided by a corrugated iron partition through the center, making a boiler room and pump room. The ventilation is obtained by monitors on the ridge of the roof, having sash on the sides. The Berlin Iron Bridge company is furnishing and erecting the steel work.

The New York and Ohio company, manufacturer of the celebrated Packard transformer, has recently brought out a new model, which is to be known as "Model 98." It is claimed that the results secured on this new model are something considerably ahead of anything that has been secured heretofore in the way of transformer regulation and efficiency. The Electric Appliance company, general western agent for the Packard transformer, is distributing special circulars, giving tabulated results of a number of tests. The manufacturers of this transformer are prepared to guarantee these results on each transformer sold, and a large fall trade is looked for on the "Model 98."

The Raster Carbon Rheostat company of Chicago is meeting with success in placing its well-known rheostats on the market. The company is now placing on the market carbon rheostats with a positive automatic release, which is claimed to be a mechanically perfect, electrically correct and positive. This rheostat is designed to meet the requirements of the most severe practice, and, with the automatic release, users can always test their full circuit before closing armature circuit. The rheostat is made of solid carbon, of an absolute resistance which is unvarying under all conditions. The Raster company also manufactures field regulators, theater dimmers and installs complete dimmer plants.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued August 16, 1898

609,015. Electric Elevator. Rudolf Eickemeyer, Yonkers, N. Y. Application filed January 5, 1891.

An electric motor coupled to an elevator and its hoisting mechanism is provided with field coils, adapted to reversals of current, for reversely driving the motor, and also provided with a governing coil, fed with currents for neutralizing the magnetization of the field coils, in proportion to undue speed of the motor, so that should the motor be operated above its normal speed after the governing coil has balanced the field coils, the motor will then operate as a generator and develop in its field coils a counteracting current, and enable the motor to then operate with self-braking effect in retarding the speed of the motor armature and of the elevator mechanism directly coupled thereto.

609,016. Electric Elevator. Rudolf Eickemeyer, Yonkers, N. Y. Application filed May 3, 1892.

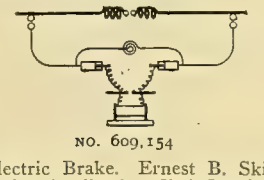
Combined with the moving car or platform is an electric motor, a reversing switch connected for reversing the appropriate current in the motor, and so short-circuiting the current that the short-circuit is operative during the reversal and inoperative during the operation of stopping the motor.

609,043. Motor Car. Charles O. Palmer, Cleveland, Ohio. Application filed April 18, 1894. Renewed January 25, 1898.

The car frame is mounted on wheels, supporting a motor thereon, with a driving wheel in operative connection with the motor, a frictionally connected driving train from the motor to the car wheels, together with a conductor from the motor to the dynamo or other source of energy, and a flexible band connection from the driving wheel to the mining machine.

609,092. Electric Controller. Joseph D. Forrer, Johnstown, Pa. Application filed July 11, 1898.

The combination of a pair of concentric shafts with operating levers for each shaft and means for preventing the removal of one of the levers except when it is at a predetermined position, and independent means for preventing the lever from being removed except when the other shaft is at a predetermined position.



NO. 609,154

609,124. Electric Brake. Ernest B. Skinner, Ogden, Utah. Application filed October 30, 1897.

The brake for the plunger or piston of the main solenoid consists of two plates, one of them carrying links, to which a lever is pivoted, and the other being a plate having a projecting portion for engagement with the lever beyond the links. There are also a slotted pin or projection through which the lever passes, a spring which encircles the slotted pin so as to bear upon the lever, and a piston or plunger for compressing the spring so as to release the brake blocks carried by the plates from the brake-operating plunger or piston.

609,142. Combined Battery and Electric Cell. Jules C. Dagoneau, Beaufort, France. Application filed January 15, 1895.

This is a combined battery and electrolytic cell, comprising a cell containing sulphate of copper, an interior cell contained therein and comprising a rectangular framework of slats and membranes secured upon this framework and constituting the walls of the interior cell, a zinc element and dilute sulphuric acid contained in the interior cell, suspension bars adapted to suspend the articles to be plated, circuit connections between the zinc plate and the bars and one or more perforated lead plates in the interior cell upon which a copper deposit will be made.

609,154. Electric Telegraphy. Oliver J. Lodge, Liverpool, England. Application filed February 1, 1898.

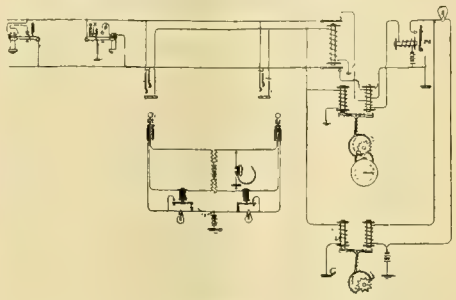
In a system of Hertzian-wave telegraphy, the combination is claimed with a pair of capacity areas, of a self-inductance coil inserted between them electrically for the purpose of prolonging any electrical oscillations excited in the system and constituting such a system a radiator of definite frequency or pitch.

609,173. Telephone System. Alfred F. Swan, Bayonne N. J. Application filed September 29, 1897.

The combination with the talking set, the line, and the switch barrel moved by makes and breaks in the line, of a movable switch arm operated from the switch barrel and adapted to cut the talking set in and out.

609,188. Electrical Traction. William Kingsland, Llandudno, England. Application filed December 23, 1897. Patented in England May 21, 1896.

Claim is made for a continuous main electrical conductor, sectional working conductors from which the motor car directly collects the current, and a number of sectional auxiliary conductors, one such for every sectional working conductor, and through which auxiliary sectional conductor the current is passed from the main conductor to the sectional working conductor aforesaid; of commutator switches situated at each end of the sectional auxiliary conductors, and a device for automatically operating the commutator switches by means of electromagnets having soft-iron armatures fixed on rocking shafts, mechanism for retaining the armatures normally in one or other of two positions so long as the magnets are not energized by a current of electricity and mechanism whereby the movement of the rocking shaft is communicated to the commutator switch.



NO. 609,331.

609,229. Telephone System. Charles E. Egan, Burton L. Lawton and Ernest C. Wilcox, Meriden, Conn. Application filed April 9, 1897.

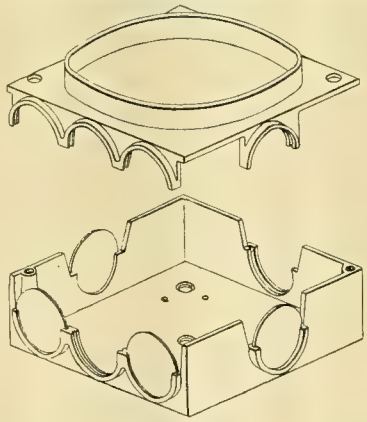
Spring jacks are provided with a central telephone connecting spring, a generator connecting spring and a subscriber's communicating spring; a plunger is fitted to reciprocate in each spring jack to engage either of the first two named springs, and a pair of connected plugs is fitted to operate a plunger and is provided with a metallic nib fitted to engage a subscriber's communicating spring.

609,245. Electrical Circuit Controller. Nikola Tesla, New York, N. Y. Application filed December 2, 1897.

The first claim is given: The combination with a receptacle of a conductor or a series of spaced conductors, a nozzle or tube for directing a jet or stream of fluid against the same, the nozzle and conductor being capable of movement relatively to each other, and means for maintaining a circulation of conducting fluid contained in the receptacle through the said nozzle, and dependent for operation upon such relative movement.

609,246. Electric Circuit Controller. Nikola Tesla, New York, N. Y. Application filed February 28, 1898.

A circuit controller comprises means for producing streams or jets of conducting liquid forming the terminals, and means for bringing the jets or streams of the respective terminals into intermittent contact with each other.



NO. 609,356.

609,247. Electric Circuit Controller. Nikola Tesla, New York, N. Y. Application filed March 12, 1898.

The receptacle is mounted to rotate about an axis inclined to the vertical; a spindle is placed within the receptacle and concentric with its axis; a weighted arm is attached to the spindle; a bracket or arm is also secured to the spindle; a rotary terminal with radiating contact arms or vanes is mounted on the bracket in position to be rotated by a body of conducting fluid contained in the receptacle when the fluid is displaced by centrifugal action.

609,248. Electric Circuit Controller. Nikola Tesla, New York, N. Y. Application filed March 12, 1898.

A conductor forms one of the terminals, with means for maintaining a jet or stream of conducting fluid forming the other terminal, and directing it against the conductor, and a body adapted to be intermittently moved through and to intercept the jet or stream.

609,249. Electric Circuit Controller. Nikola Tesla, New York, N. Y. Application filed March 12, 1898.

The features described include a closed rotary receptacle, a rigid conductor mounted within the same and through which the circuit is intermittently established, and means for directing a jet or stream of a fluid which is contained in the receptacle against the body so as to effect its rotation independently of the receptacle.

609,250. Electrical Igniter for Gas Engines. Nikola Tesla, New York, N. Y. Application filed February 17, 1897. Renewed June 15, 1898.

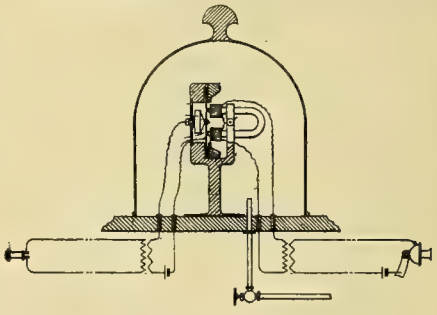
In a gas or explosive engine there is the combination with a moving part of the engine of a circuit closer or switch controlling the charging and discharging of a condenser, separated terminals in the cylinder or explosive chamber, and a transformer through the primary of which the condenser discharges, the secondary being connected with the terminals in the cylinder.

609,251. Electric Circuit Controller. Nikola Tesla, New York, N. Y. Application filed June 3, 1897. Renewed June 15, 1898.

A circuit controller comprises a receptacle containing a fluid, means for rotating the receptacle, and a terminal supported independently of the receptacle and adapted to make and break electric connection with the receptacle through the fluid.

609,252. Electric Rail Bond. Joseph S. Tucker, Chicago, Ill. Application filed January 20, 1897.

A rail bond is described comprising a conductor having its end portions provided with inwardly tapering enlarged heads, the heads being provided at their inner or smaller ends with flanges.



NO. 609,374.

609,274. System of Control of Electric Motors. Edwin R. Gill, Englewood, N. J. Application filed April 4, 1898.

A power regulator, a controlling actuator, an electromagnetic engager adapted to cause engagement between the regulator and actuator, electric circuits for energizing the engager, an engagement interrupter moving with the engager for controlling the circuits at one set of terminals and a manipulator for controlling the circuits at another set of terminals.

609,288. Means for Fastening Insulator Pins to Cross-arms. Loron Mitchell, Augusta, Ga. Application filed May 10, 1898.

An insulator pin having its shank provided with a groove triangular in cross-section, and a locking device carried by the groove and adapted for frictional engagement with the wall of an opening into which the shank of the pin may be passed.

609,331. Telephonic Measured-service System. William W. Dean, Boston, Mass. Application filed November 16, 1897.

The apparatus includes call-sending devices at the substations, call-answering devices at the central station, and two call-registering mechanisms associated with the circuit at the central station, actuated by the normal operation, successively, of the call-sending devices of either substation and the central call-answering devices for discriminatively counting and registering the calls of the said sub-stations.

609,356. Electrical Conduit Box. Hubert Krantz, New York, N. Y. Application filed May 6, 1898.

A split conduit box is provided with corresponding semicircular rims on the two parts of the box to form the outlet openings for the conduits, in combination with closing disks held in place by the two parts of the box when fitted together.

609,374. Telephone Repeater or Relay. John S. Stone, Boston, Mass. Application filed December 29, 1897.

This instrument comprises an electromagnet in one circuit, transmitting electrodes in a second circuit, a diaphragm common to both the electromagnet and the transmitting electrodes, and a vacuum chamber inclosing the magnet, electrodes and diaphragm.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, SEPTEMBER 3, 1898. No. 10

Albion E. Lang, President American Street Railway Association.

The presiding officer of the American Street Railway association, Mr. Albion E. Lang of Toledo, O., is the sixteenth incumbent of that office, and is well qualified to sustain the dignity of the position. President Lang is an experienced street-railway man, and as he has been interested in the work of the association for more than 10 years he is familiar with the needs of the organization and the companies composing it. He held several offices prior to his election to the presidency and has always displayed an intelligent interest in the work of the organization. It is particularly appropriate that the presiding officer at the present time should have personal knowledge of the growth of the industry since the formation of the association in Boston, 16 years ago. It is well, too, that he should be a progressive character, abreast of the development in the industry and awake to the possibilities in the development of the facilities at hand. President Lang's record shows that in these essential particulars he is especially well fitted for the office, and there is no doubt that he will prove a satisfactory presiding officer.

Albion E. Lang is a native of Ohio; he has lived in that state all his life and all his business interests are centered there. He was born at Huntington in 1849, but the early years of his life were passed at Wellington. Seventeen years ago he entered the street-railway field at Toledo, and he has been engaged in the business ever since. His first venture was in the purchase of a horse-car line, not a very important undertaking, viewed in the light of street-railway deals at the present time, but it served to interest him in the industry. Another line was purchased and operated in conjunction with the first road in 1885, and when the advantages of consolidation became apparent, further acquisitions were made four years later. This proved a profitable investment, and in 1896 Mr. Lang secured the consolidation of all the street-railway lines of the city and is now conducting them under the management of the Toledo Traction company. The nucleus of the present street-railway system, the first line purchased by Mr. Lang in 1881, is the old Monroe and Dorr street railroad of Toledo. The business at that time was badly cut up. There were five other railroad companies in the city, and it was only after the most persistent efforts that Mr. Lang succeeded in uniting these roads into one company, under the name of the Toledo Consolidated Street Railway company. He became successively the secretary, vice-president and general manager, and ultimately the president. Later on the Consolidated company acquired two other companies that had been formed, and a second consolidation ensued in 1895 under the name of the Toledo Traction company, and Mr. Lang has been president of the new company since its organization.

The city of Toledo is now furnished exceptionally fine street-railway service. It has a network of 120 miles of track, supplying all parts of the city, and the people are well satisfied with the service. Mr. Lang personally directs the management of the system. He has done much to improve the condition of the workingmen employed by the company, and he believes that this interest has not been without good returns, as the company has been fortunate in all its dealings with its employes.

Mr. Lang has other interests besides those involved in the management of street-railway lines. He is president of the Toledo Consolidated Electric company, which controls the electric-lighting business of Toledo. This company is the successor to the business of the Western Electric Light and Power company and the Toledo Electric Street Railway company. This corporation has the city lighting contract and furnishes commercial lighting and power.

The Toledo Traction company and the Toledo Consolidated Electric company control the street-railway and lighting properties of Toledo, a city of 135,000 inhabitants. Both concerns take current from the same power house, thus effecting a very economical production.

Mr. Lang is a member of the National Electric Light association, the Ohio Electric Light association and the Ohio State Tramway association. He was president of the last-named organization in 1893. In 1891 he was elected third vice-president of the American Street Railway association and performed valuable service in the executive committee during his term of office. His selection for the presidency at Niagara Falls last year was entirely unsolicited by him and unexpected. It was a well-deserved recognition of his work for the association and a graceful tribute to his personal worth.

President Lang entertains very decided opinions upon the relation of quasi-public corporations and municipal bodies. His experience has brought him into almost constant dealings with city officials, and in his capacity as manager of public lighting and transportation companies he has had exceptional facilities for studying the public mind on this question. His views were concisely expressed in his lecture at Purdue University, Lafayette, Ind., April 26th, on "Electric Power Companies and Their Relations to Municipalities," which was published in the Western Electrician of May 7th. The gist of this address is contained in the following paragraphs:

"I do not believe that municipal ownership of such properties is wise in any sense nor that much will be done in this direction, especially not if private corporations keep pace with the best methods of service and offer reasonable rates.

"I am one who believes that the community will deal with these corporations fairly, if the corporations will be equally fair with the community. Some

ALBION E. LANG.

corporations are too exacting—too much inclined to reap a harvest of quick return by way of dividends and provide a rapidly accumulating sinking fund to wipe out original investment.

"This method, though Yankee-like and generally called business-like, is not a prudent or wise way of handling corporations depending on the public for their existence. A better way, it seems to me, is to take the public into your confidence, deal fairly and even generously with it, give the best possible service at the smallest profit consistent with a fair return on the investment and reasonable provision for meeting outstanding obligations and future depreciation, in which event the community will deal fairly with you.

"Citizens should be made acquainted with all the conditions governing properties of this kind, should be informed of the reason for incurring the debts which generally exist and of the annual and contingent burdens we assume. Fulfilling these conditions, fair prices will usually be allowed for transporting passengers upon our railways and for power and light supplied."

Mr. Lang believes in private ownership of lighting and street-railway plants, but he appreciates the responsibilities of the companies operating them and their obligations to the public from which they derive their franchises and upon which they depend for support.

Scientists in Boston.

The fiftieth anniversary meeting of the American Association for the Advancement of Science was held in Boston last week. The opening session was held on Monday at the Massachusetts Institute of Theology, and many eminent scientists were in attendance. On the platform was a distinguished company, including the governor of Massachusetts, the mayor of Boston, Bishop Lawrence and other clergymen. From abroad were Professor Desire Charnay of Paris, Dr. A. Sasse of Zaandam, Holland; Professor Benjamin Howard and Conrad W. Cooke of London. Others on the platform were President G. Stanley Hall of Clark University; President Thomas C. Mendenhall of the Polytechnic Institute, Worcester; the Rev. Dr. E. E. Hale, the Rev. James De Normandie and Edwin F. Miller of Wakefield.

The meeting was called to order by Professor Wolcott Gibbs of Newport, the retiring president. Bishop William Lawrence offered prayer. Professor Gibbs then introduced Governor Wolcott, to extend the greetings of the commonwealth. Mayor Quincy followed with the city's welcome. President J. M. Crafts of the Massachusetts Institute of Technology welcomed the association. The president-elect, F. W. Putnam of Harvard University, was introduced by the retiring president, and received a hearty greeting. Professor Desire Charnay spoke briefly in French. A message was read from the Russian Geological Committee of St. Petersburg, sending to the American association respectful congratulations and good wishes.

The scientific work of the association was done through the sections into which it is divided and which met separately. One paper in the chemical section was on "The Electric Current in Organic Chemistry." Charles F. Brush read a preliminary paper of great interest on "A New Gas." The gas is a constituent of the atmosphere and is found absorbed in many substances. Its chief characteristic thus far experimentally determined is enormous heat conductivity and low pressure. Mr. Brush showed that its conductivity, even when mixed with a large excess of other gases, is something like a hundred times that of hydrogen, the best gaseous conductor heretofore known. He conjectures that the conductivity of the pure gas will be found a thousand or more times that of hydrogen. Mr. Brush discovered the new gas nearly a year and a half ago. After many months of experimenting he has recently effected partial separation of the new gas from the air by diffusions. In the first diffusion the heat conductivity of the air was increased something like a hundredfold. Mr. Brush expects to obtain the gas in a state of approximate purity by successive diffusions of air.

An excursion to Salem and trips to other points of interest varied the work of the week with pleasure.

New York State Street Railway Association.

The sixteenth annual convention of the New York State Street Railway association will be held at the Hotel St. George, Brooklyn, on September 13th and 14th. Among the subjects upon which papers will be presented at the meeting are:

Points on the care of dynamos.
The use and abuse of transfers.
How can we increase our receipts?
Low joints; how to prevent them.
The power station from an economic standpoint.
The office; suggestions for records, reports, etc.
Track bonding; how can we obtain the best results?
Street railroad versus the state; the relation to each system for single-track roads.
General track construction; the most approved method of freight and express service on suburban and interurban lines.
Are air and power brakes on electric cars practicable?
The most approved plan of long-distance power transmission.
The best method of preventing accidents.
Pleasure resorts as a means of stimulating travel; are they profitable?
The effect upon street railroads of the application of electricity to steam; possibilities and advantages from an up-to-date street-car service and why the rate of fare should not be reduced.
Daily inspection of car equipment, and how can we accomplish the best results?
Receipts from other sources.
How to obtain best results from sale of advertising privileges, power, etc.

An ordinance authorizing C. M. Winter and J. B. Slater to erect and maintain a system of electric telephone and telegraph wires and appliances in Colville, Stevens county, Washington, was passed and approved.

AMERICAN STREET RAILWAY ASSOCIATION.

This year's meeting of the American Street Railway association, the seventeenth annual convention of that body, will assemble in Boston on Tuesday, September 6th, and continue in session four days. The programme has already been published and the plans for the exhibition to be held in connection with the meeting in the Mechanics' Institute have also been presented in the Western Electrician. This year's gathering will be particularly interesting, as it is the first time the association has met in Boston since it was formed in that city, 16 years ago. A comparison of the condition of the industry at that time and the present development is at once suggested, and a brief review of the history of the organization and reference to the proceedings of the several meetings that have since been held cannot fail to be interesting and instructive. Accompanying this article are presented portraits of former presiding officers of the association, beginning with the chairman of the preliminary meeting in Boston on December 12, 1882, at which the details of organization were perfected, and portraits of the two gentlemen who have filled the office of secretary.

Moody Merrill (1882).

H. H. Littell (1883).

William H. Hazzard (1884).

Calvin A. Richards (1885).

Julius S. Walsh (1886).

Thomas W. Ackley (1887).

C. B. Holmes (1888).

G. B. Kerper (1889).

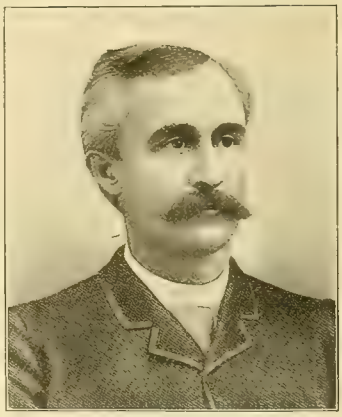
Thomas Lowry (1890).

Henry M. Watson (1891).

John G. Holmes (1892).

D. F. Longstreet (1893).

Henry C. Payne (1894).


Joel Hurt (1895).

H. M. Littell (1896).

Robert McCulloch (1897).

AMERICAN STREET RAILWAY ASSOCIATION.—PRESIDING OFFICERS, 1882 TO 1897.

The first step toward effecting an organization of this kind was taken by H. H. Littell, superintendent of the Louisville City Railway company, who issued a circular on November 8, 1882, inviting the street-railway men of the country to assemble at Boston to discuss the advisability of forming an organization, "the object of which shall be the promotion and advancement of knowledge, scientific and practical, in all matters relating to the construction, equipment and management of street railways; the establishment and maintenance of a spirit of fraternity among the members of the association, by social intercourse and friendly interchange of information and ideas, to the end that the best service may be obtained at the least possible cost."

In response to this invitation 54 representatives of street-railway interests gathered at Young's

Hotel Boston, and held a two-days' session at which the organization of the American Street Railway association was perfected, officers elected and a constitution adopted. The Hon. Moody Merrill, president of the Highland Street Railway company, was chairman of the preliminary meeting. In his opening address he gave an idea of the condition of street-railway properties at that time, which forms an interesting chapter in the history of the industry. An abstract is reproduced from the official report:

The street railways of this country have grown so rapidly during the last ten years, and are still growing with such rapidity, that an association of this character seems highly desirable. There are now organized and doing business in this country and Canada 415 street railways. These companies employ an army of about 35,000 men. They run 18,000 cars, which, with the horses attached, would make a solid line of cars reaching from Boston to Albany. More than 100,000 horses are in daily use, and calculating that the average life of a horse in street-railway service is four years, it makes the consumption of horses 25 000 per year, a fact of much importance to the farmers of the country, east, west, north and south. To feed this vast number of horses requires annually 150,000 tons of hay and 11,000,000 bushels of grain. These companies own and operate over 3,000 miles of track—nearly enough to span the country from Boston to San Francisco. The whole number of passengers carried annually is over 1,212,400,000, or a number nearly equal to the entire population of the globe. The amount of capital invested in these railways exceeds $150,000,000, with absolutely no security but the faithful and satisfactory service rendered the traveling public by the companies themselves. The objects of this contemplated association should be the advancement of scientific and practical knowledge in the construction, equipment and management of street railways. The public is continually requiring of us a better and higher order of service, for while, ten years ago, the street cars were run almost exclusively for the accommodation of the poorer and middle classes, now the wealthier classes are our most liberal patrons. A few years ago the cab and the hack were the only vehicles called in requisition for the lecture, the concert and the theater, but now the street car is almost exclusively patronized for that purpose. This change in the character of our patronage demands continual improvement in our service. It would seem to be important that there be established a central office or bureau, where the improvements in the service of the different companies could be reported, and where all reports of the decisions of the courts in patent cases and damage suits affecting street railways should be kept, so that any member of the association could have access to them. There should also be kept at this office correct information concerning the state of the horse, hay and grain markets in the different sections of the country, so that reliable information concerning all these vital interests can be obtained at all times.

When the report of the committee on constitution and by-laws was presented Mr. Kerper called attention to the fact that the word "American" was used in the title of the association, and expressed a fear that the gentlemen from Canada might feel that they were excluded. Mr. Cleminshaw, of the committee, said that the word was to be understood in its broadest sense, including America, North and South. Mr. Robillard of Montreal suggested that the title "North American" be substituted. Mr. Cleminshaw said that point came up in the committee, and it was announced that several South American roads would, probably, want to join the association. Mr. Crawford of Montreal said that the impression made upon his mind by the use of the word "American" was that it was intended to include the Canadas or South America, or any other portion of the American continent. The chairman said that was the understanding, and asked if it was satisfactory to the gentlemen from Canada, to which Mr. Crawford replied "Perfectly;" that he had paid very particular attention to the reading of the report, and he thought it exceedingly comprehensive and reflected great credit upon the composers of it.

The honor of being selected as the first president of the association was conferred upon H. H. Littell of Louisville, who had done so much to bring about the formation of the organization. William J. Richardson of Brooklyn was selected secretary at the same meeting and he was continued in that office up to the time of his death in 1895. At the conclusion of the meeting the delegates were entertained at a banquet given by the presidents of the Boston street-railway companies, six of which were represented at the convention. Another interesting feature of this meeting was the appointment of committees on special subjects for consideration at the next meeting. It was decided, for instance, to have a paper on "Horse-shoeing," which was a topic of considerable importance until the advent of the electric motor.

The complete list of presiding officers up to the present time and the meetings at which they officiated is appended:

Boston (preliminary meeting), December 12, 1882.—Moody Merrill, president Highland Street Railway company of Boston, chairman.

Chicago, October 9, 1883.—H. H. Littell, general manager Louisville City Railway company of Louisville.

New York, October 15, 1884.—William H. Hazzard, president Brooklyn City Railroad company of Brooklyn.

St. Louis, October 21, 1885.—Calvin A. Richards, president Metropolitan Railroad company of Boston.

Cincinnati, October 20, 1886.—Julius S. Walsh, president Citizens' Street Railway company of St. Louis.

Philadelphia, October 19, 1887.—Thomas W. Ackley, president Thirteenth and Fifteenth Streets Passenger Railway company of Philadelphia.

Washington, October 17, 1888.—Charles B. Holmes, president Chicago City Railway company of Chicago.

Minneapolis, October 16, 1889.—George B. Kerper, president Mount Adams and Eden Park Inclined Railway company, Cincinnati.

Buffalo, October 15, 1890.—Thomas Lowry, president Minneapolis and St. Paul Street Railway companies of Minneapolis.

Pittsburg, October 21, 1891.—Henry M. Watson, president Buffalo Railway company of Buffalo.

Cleveland, October 19, 1892.—John G. Holmes, president Citizens' Traction company of Pittsburg.

Milwaukee, October 18, 1893.—D. F. Longstreet, vice-president and general manager West End Street Railroad company of Denver.

Atlanta, October 17, 1894.—Henry C. Payne, vice-president Milwaukee Street Railway company of Milwaukee.

Montreal, October 15, 1895.—Joel Hurt, president Atlanta Consolidated Street Railway company of Atlanta.

St. Louis, October 20, 1896.—H. M. Littell, vice-president and general manager Metropolitan Street Railway company of New York.

Niagara Falls, October 19, 1897.—Robert McCulloch, vice-president and general manager Citizens', Cass Avenue and St. Louis Railroad companies of St. Louis.

As already stated, there have been but two secretaries of the association. William J. Richardson, secretary and treasurer of the Atlantic Avenue Railroad company of Brooklyn was selected at the first meeting of the association and he continued to discharge the duties of his office until his death. At the meeting held in Montreal in October, 1895, Mr. T. C. Penington, treasurer of the Chicago City Railway company, was elected to succeed Mr. Richardson, and he has since conducted the office in a very satisfactory manner.

The association from the beginning gave evidence of the important part it was to play in the development of the great industry in which its members were interested. Its proceedings were essentially practical in every respect. The members did not favor theorizing. They tolerated consideration of the propositions to use electricity and the cable, but they devoted the greater part of their meetings to such subjects as "Track-cleaning and Removal of Snow and Ice," "Stables and Care of Horses," the proper method of shoeing horses and the best quality of feed for them.

It is worthy of note that the first system of electric propulsion that engaged the attention of the association was the conduit trolley system. This was the subject of a report by a special committee at the New York convention of 1884, and was discussed at subsequent meetings until 1890, when President Lowry, in his address at Buffalo, said he was "so thoroughly convinced that electricity was the coming power for street railways" that he believed the Buffalo gathering would be "the last convention that will ever seriously consider horses for the operation of street railways." From that time it may be said the association became an electrical organization. The questions discussed related chiefly to electrical construction, equipment and operation, and much of the improvement and development that have followed may be justly attributed to the American Street Railway association. The exhibitions of late years have come to be regarded as a most important feature of every meeting. It is certainly a profitable investment for manufacturers, as can be shown by the eagernees they display in getting space for exhibition purposes.

The culmination of these efforts, the result of the experience gained in former meetings, and the interest that has been developed in everything pertaining to the association and its work, are shown in the preparations for this year's convention at Boston. The programme is one of the most attractive that has ever been prepared and the exhibition arranged will be the most complete display of street-railway machinery and appliances that has ever been collected for a similar event. The entertainment will be in keeping with the rest of the programme.

Thomas C. Penington.

William J. Richardson.

AMERICAN STREET RAILWAY ASSOCIATION.—SECRETARIES.

COMMUNICATIONS.

Failure of Water Power on the Pacific Coast.

To the Editor of the Western Electrician:

In Mr. Eastwood's communication appearing in your issue for August 20th, it is stated, in commenting upon the failure of the San Joaquin water supply, that "all of the other transmission plants of the state have been likewise crippled by the extreme drought." The Central California Electric company's plant at Newcastle to Sacramento has suffered no annoyance, and it has been and is now soliciting new business. Its customers have not been subjected to the slightest inconvenience. C. VAN NORDEN.

Sacramento, Cal., August 22, 1898.

Mr. Berg on Power Transmission.

To the Editor of the Western Electrician:

I have just noticed an abstract in the Electrical World of a paper written by me on power transmission, and read before the Ohio Electric Light association. I find that this abstract is very misleading indeed, and the conclusions drawn from my paper are entirely wrong. The reason for this is that the editor of the Electrical World has not quoted me properly; therefore, to be sure, in case you should consider mentioning my paper in your periodical, that you will not be led into the same conclusions, I will bring out the point which he omitted and which I stated in the first part of the paper; namely, that although the title of the paper was "Long-distance Transmisison of Power," the very first paragraph of the paper stated that I limit the problem to power transmission for lighting and lighting with incidental motor load; consequently the article does not refer to conditions where motor load is of first importance. Under such conditions multiphase systems are preferable to single-phase systems. I should be glad if you not only stated this in your paper, but also referred to the error committed by the Electrical World in this respect.

ERNST BERG.

Schenectady, N. Y., August 25, 1898.

[The manuscript of Mr. Berg's paper and the revised report of the discussion are in the possession of the Western Electrician, and an effort will be made to publish them at an early day.—Editor.]

Military Telegraphers Overworked.

A dispatch from Washington, dated August 25th, states that five telegraph operators employed in the telegraph office of the War Department resigned because they objected to the long hours of labor required. During the war the amount of telegraphic business at the department was enormous, and since the cessation of hostilities there have been about as many messages as before. Cable dispatches are received at all times of day and night, and it is necessary to keep at least one operator in the office constantly. The men who resigned compose the whole force of War Department telegraphers, except Chief Operator Pierson, who was made a second lieutenant in the Volunteeer Signal Corps after the war broke out, and who appreciates the dignity of his position as an army officer too keenly to desert his post. The operators who left complained that they were often obliged to work from 18 to 20 hours without sleep and without pay for overtime. These operators were employed by the government.

The City Council of Tallahassee has passed a resolution that steps be taken immediately for the establishment of an electric-light plant.

Steam Locomotives Supplanted by Electric Trolley.

By Orrin E. Dunlap.

The Buffalo and Lockport Railway company has placed its new line connecting the county seats of Erie and Niagara counties in operation. The completion of the road marks a significant advancement of electricity in a field heretofore occupied by steam power. From Buffalo to North Tonawanda the cars of the Buffalo and Lockport line at present use the tracks of the Buffalo and Niagara Falls Railway company, but in the future it is expected that an independent connection will be established with Buffalo, possibly creating a belt line. From North Tonawanda to Lockport the Buffalo-Lockport cars are run over the old Tonawanda-Lockport branch of the Erie railroad. This branch has been leased by the Buffalo and Lockport Railway company, and the line fitted for electric service. On taking possession the Buffalo and Lockport Railway company found the track in fair condition. The rails used by the Erie company were of the 60-pound type, and about two miles out of Lockport a mile of track was relaid with 80-pound rails.

The contractors in charge of the reconstruction of the line were J. G. White & Co., and they had as their superintendent John A. Wilson. Quick work was necessary, and Mr. Wilson was especially fitted for the task, as he had had considerable experience in construction in the Niagara locality, having built the Buffalo and Niagara Falls electric road and the Buffalo-Niagara power-transmission line. The road from North Tonawanda to Lockport is a single track. At present it has three switches or turnouts, and it is possible that more will be placed. One of these turnouts is a mile west of Lockport, another six miles and the third 10 miles. In bonding the track two gangs were employed, one working days and the other nights. About 20 days was occupied in bonding the track, a three-inch horseshoe bond with 0000 wire being used underneath the rail. The trolley wire is put up with a double line of poles set 88 feet apart, excepting for about three-quarters of a mile in North Tonawanda, where an arm support is used. Along the poles on the north side of the track two 5,000,000 circular-mil feeder cables are strung, while on the south side of the right-of-way a power transmission line has been built. This transmission line taps the Buffalo-Niagara Falls power transmission line at North Tonawanda. The poles are set 100 feet apart and on the single crossarm three 0000 wires are strung. The insulators used are the same as those employed on the Buffalo-Niagara Falls transmission line. The tops of all the poles are 22 feet above the rail. In erecting the wires a construction train was employed consisting of three flat-cars, a caboose and an engine. A six horse power hoisting engine was located on one of the flats to aid in picking up and raising the poles. In stringing the wire the train was kept in motion and the wire was laid from a boom on one of the cars across the poles, about five miles of wire being run out each day. The plan of the company is to feed the Lockport end from the Lockport transformer station, and the Tonawanda end from a transformer station there. In leasing the Erie branch the Buffalo and Lockport Railway company secures possession of the neat and commodious stations along the line, and in the rear of the Lockport depot it has erected a spacious car-storage barn, transformer room and workshop. This building is of brick and has a steel truss roof. In the transformer room a view of which is presented in Fig. 1, two 500 horse power rotary converters have been installed, together with the necessary static transformers and switchboards. Fig. 2 shows the switchboards.

The length of the route from Lockport to Buffalo is about 25 miles. The distance from North Tonawanda to Lockport is about 13 miles, and for over 10 miles of this distance the road is as straight as the flight of an arrow, a fact which will allow exceptionally good time to be made. This part of the road is shown in Fig. 4. The transportation

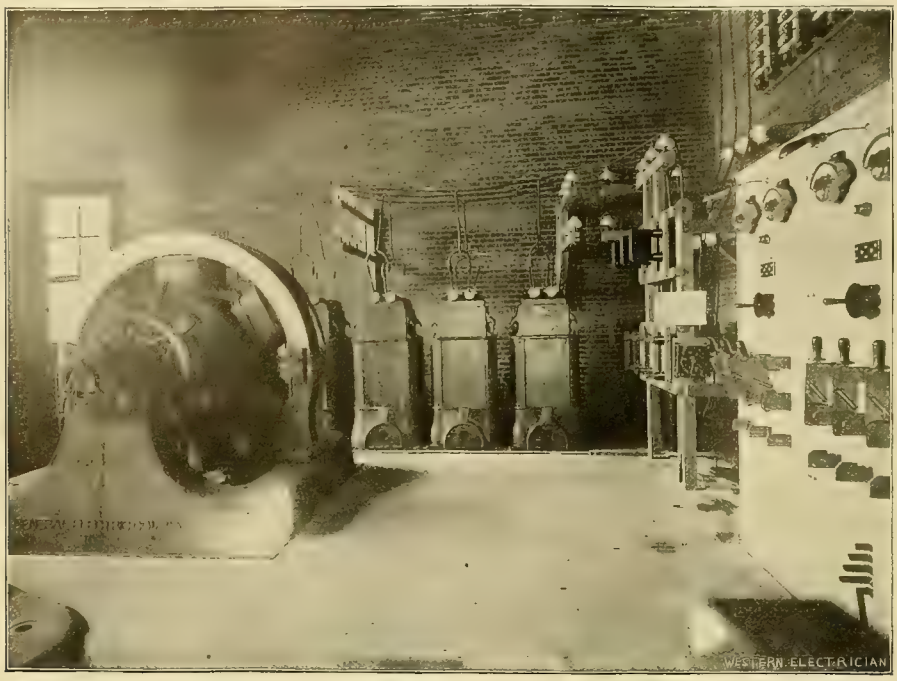


FIG. 1. STEAM LOCOMOTIVES SUPPLANTED BY ELECTRIC TROLLEY.—TRANSFORMER ROOM IN LOCKPORT, SHOWING ROTARY CONVERTER, STATIC TRANSFORMERS AND SWITCHBOARD.

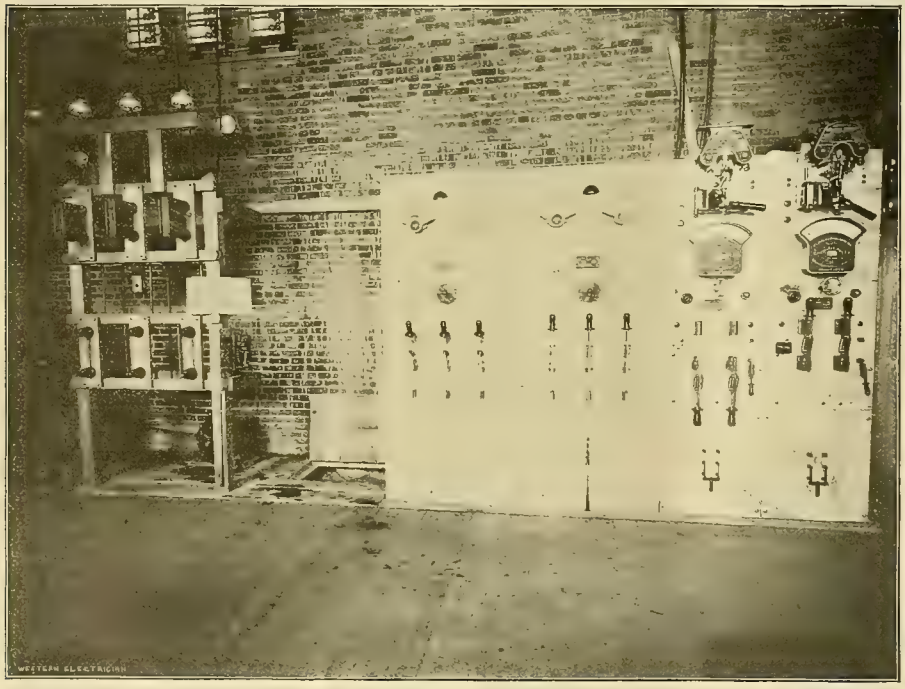


FIG. 2. STEAM LOCOMOTIVES SUPPLANTED BY ELECTRIC TROLLEY.—SWITCHBOARDS OF THE LOCKPORT TRANSFORMER STATION.

Fig. 3. Electric Locomotive in use on the Buffalo and Lockport Line.

Fig. 4. "For 10 miles or more the track is as straight as the flight of an arrow."

Fig. 5. Cars passing at Pendleton Centre.

Fig. 6. "Good-bye, old Erie." One of the last trains over the line.

equipment of the road consists of 10 cars, two of them being combination baggage and passenger and eight being combination smokers. Each car is fitted with four G E 57 motors, having a rated capacity of 52 horse power, thus giving each car 208 horse power. The cars were made by the Brill company of Philadelphia, and in color resemble the "yellow fellows" of the Buffalo and Niagara Falls road. They are very large and apparently well fitted for the service they were built to perform. In addition to the cars the company has purchased two General Electric locomotives, each of which weighs 45 tons and has four No. 55 motors. They have a guaranteed speed of 15 miles an hour, and they have been known to draw 28 loaded cars with good results. It is a fact worth noting that this type of locomotive (Fig. 3) is the same as will be employed on the underground roads in London, England. To the Buffalo and Lockport Railway company the use of these locomotives is destined to be especially valuable, from the fact that the company already has a large freight business from Lockport to North Tonawanda. Succeeding, as it did, the full train service of the Erie road between these two points, a heavy freight business fell to it to care for, and it was deemed necessary to place an early order for these locomotives. Still another feature of importance is the fact that the Buffalo and Lockport Railway company owns and controls the Lock City road, and under the franchise has the right to haul freight through the streets of Lockport between the hours of 11 p. m. and 5 a. m. Lockport is a manufacturing city of some magnitude, and, as the tracks of the local company run to the mills, considerable freight is obtained, which is turned over to the Erie at North Tonawanda. It is also a great convenience on special occasions. In a recent case, when the firemen of Lockport were going on an excursion, a sleeping coach and a car of the Erie were run to Lockport, which the firemen boarded, and were drawn by one of the electric locomotives to North Tonawanda, where connection was made with the Erie passenger train, thus saving the annoyance of transferring.

There is every probability that the Buffalo and Lockport company will very early extend the line to Olcott on Lake Ontario, passing a rich farming country, from which much freight is likely to be secured. Other possibilities of profitable patronage open before the road to lead the company to extend it eastward toward the city of Rochester. Between Lockport and Rochester there are many well-populated, busy, thriving villages that would welcome the entrance of a trunk-line electric road to their boundaries. The country through which the line runs from North Tonawanda to Lockport is well settled, and it may be said that the farmers living along the line welcome the advent of the trolley. One important reason for this is that with

JOHN A. WILSON.

the passing of the steam locomotive from the tracks the danger of fire from flying sparks among their crops is materially lessened. The train service of the Erie consisted of four passenger trains each way on week days and one freight. It is the intention of the Buffalo and Lockport Railway company to give a half-hour service between Buffalo and Lockport, which materially increases the accommodations of the line for passenger traffic to the county seats in Erie and Niagara and intervening points. The time consumed in making the run from Buffalo to Lockport is a little over an hour, and about the same time is made between Niagara Falls and Lockport, a change of cars being at present made in North Tonawanda.

In constructing the Buffalo-Niagara power-transmission line the Niagara Falls Power company purchased a strip of land 30 feet wide for a greater part of the distance. In the case of the transmission of Niagara power to Lockport, the route of the new electric line is sufficiently wide to allow a substantial portion of it to be used for power-transmission purposes, and the taking of Niagara power to Lockport for the operation of this new trolley line may be the means of considerable Niagara power being transmitted to the Lock City for use in the manufacturing plants there. Lockport is not well provided at present with power facilities, and it would certainly welcome such a substantial addition to its force as a portion of the product of the great dynamos of Niagara.

The president of the Buffalo and Lockport Railway company is the Hon. W. Caryl Ely of Niagara Falls. Mr. Ely is also president of the Buffalo and Niagara Falls Electric Railway company, and last year he was honored by election as first vice-president of the American Street Railway association.

W. CARYL ELY.

Mr. Ely is an attorney who has been attracted to street-railway construction by the possibilities he saw in the construction of rapid-running roads through sections of country bordering on such cities as Niagara Falls, Buffalo and Lockport. He has always been much interested in the electrical development in and about Niagara, and has organized many successful companies. He was born in Middlefield, N. Y., February 25, 1856. His education was obtained in Cooperstown, N. Y., Girard, Pa., Franklin, N. Y., and Cornell University. In 1882 he was admitted to the bar, and in 1883-85 was a member of the New York State Assembly. His residence at Niagara Falls dates back to 1885. Mr. Ely's success at Niagara has been phenomenal, and Niagara won much by his selecting it as a place of residence and business. In his profession Mr. Ely has a very high standing. His ability, tact and integrity will do much for the advancement of electric-railway interests.

The general manager of the Buffalo and Lockport company is Burt Van Horn, who also holds a similar position on the Buffalo and Niagara Falls road. Mr. Van Horn was born in Niagara County and was educated in the Lockport schools. He graduated from the Columbia Law School in 1878 and was admitted to the bar in the same year. Mr. Van Horn was one of the promoters of the Buffalo and Niagara Falls road, and as he knows quite well the transportation facilities needed in Lockport, the people of that city are well pleased to know that he will look after their welfare in this respect. Mr. Van Horn is an active man and is well qualified to manage such properties as those with which he is connected in western New York.

The superintendent of the new line is C. K. Marshall, who was born in Niagara Falls. He is superintendent of the Buffalo and Niagara Falls road, and is noted for getting his cars through on time.

From this review of the officers of the Buffalo and Lockport Railway company it will be seen that its interests are closely allied to those of the Buffalo and Niagara Falls Electric Railway company. The success that road has met has portrayed the energy of the men behind it, and this energy will now be devoted to developing the resources of the two electric roads.

The Buffalo, Kenmore and Tonawanda electric railway has been sold to Attorney Morris Cohn for $63,147.32, the amount of the first-mortgage bonds held by him, and with the understanding that he shall satisfy a claim of $28,000 held by the assignees. This will make the sale price about $91,147.32. The sale was made by the referee, Frederick Chormann of Niagara Falls, as the result of a foreclosure action brought by the Fidelity Trust and Guaranty company as trustee for the bondholders. The sale began Monday morning, August 22d, and was twice postponed to give Fred and Charles Gay of New York, who bid $95,000, opportunity to make a deposit of $3,000, required by the terms of the sale from the highest bidder. On Tuesday, August 23d, the sale was made to Mr. Cohn. It is said that this road has never paid running expenses. It comprises about five miles of track and roadbed, a power house, four cars and a small piece of real estate. Mr. Cohn, the purchaser, is a member of the law firm of Ely, Dudley & Cohn on Niagara Falls. It is stated that the road will be made a portion of the Buffalo and Lockport Railway company's system, and that it will be utilized to enter the city of Buffalo independently of the tracks of the Buffalo and Niagara Falls road. It may be made a portion of a belt line around Buffalo.

Electric Power for San Francisco Printing Establishments.

In the printing and publishing district of San Francisco steam power for the machinery of the various establishments has been supplied by the Commercial Steam Power Works for over 30 years. About two years ago this company installed a large electric plant for the purpose of furnishing light and power to that section. With its increased facilities it became a strong competitor of the big electrical companies and gradually extended its lines throughout the district. The San Francisco Gas and Electric Light company began negotiations for the purchase of the property of the rival company. In order to obtain the sentiment of the job printers and allied trades on the proposed change to electric motors, a meeting of the Typothetæ was held and a vote on the question as to whether it would be an advantage or disadvantage to accept the change was taken. With but a few exceptions the impression was general that the new system would be a marked advantage. After considerable discussion, the few who withheld from voting it into general favor accepted the conditions, which required each firm to purchase and keep in repair all motors used. The concessions, if any, offered by the new company were not made public, but it is stated that they are reasonable. The old steam plant will be taken out.

BOOK NOTES.

Vol. VI. of "The Mineral Industry" is now ready for delivery. It gives the statistics and technology of mining and metallurgy in the United States and other countries to the end of the year 1897. This excellent annual is well known to the engineers of the United States and has been referred to several times in the columns of the Western Electrician. It is edited by Richard P. Rothwell and published by the Scientific Publishing company of New York at $5.

"Street Railway Roadbed" is the title of a publication just issued by the Street Railway Publishing company of New York, and it serves as an index to

BURT VAN HORN.

the contents of the volume. It is made up largely of contributions that have already appeared in the Street Railway Journal, Engineering News and the proceedings of the American Society of Civil Engineers, amplified and brought down to date. The book is the joint work of Mason D. Pratt and C. A. Alden, whose practical experience in track construction insures a thorough, comprehensive and up-to-date treatment of the subjects discussed. This is the only book treating particularly of street-railway roadbed, the conditions of which differ so widely from those of steam-railroad track construction as seemingly to demand a special treatise. It describes and discusses the different forms of rails, character of track construction and special work, and also instructs the reader in the proper manner of building track, laying out spiral curves, and presents valuable tables to aid in this latter work. The book contains 135 pages, is supplied with an index, and its price is $2.

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Advices from all parts of the country indicate that electrical storms were exceedingly frequent and violent during the month of August. These atmospheric disturbances have not been confined to this country or hemisphere, however, as is shown by the cable dispatches. A severe thunderstorm visited Paris on August 23d and caused considerable damage. London likewise suffered, but in a less degree. From Copenhagen on August 23d comes the news that a terrible thunderstorm swept the whole Jutland peninsula, that many outbuildings were struck by lightning, six persons being killed and 39 farm buildings and 13 houses being burned.

It is certainly a very honest tribute to the work of American printers, engravers, ink-makers, paper-makers, binders and embossers that a large printing and publishing concern in Glasgow, in advertising its plant and product to the engineering trades for catalogue work, should declare that its "expensive machinery has been purposely laid down in order to equal, if not excel, the iron-rtade catalogues produced across the ocean, and known as the American style." Without doubt the best arranged and most beautiful trade catalogues in the world are made in the United States, and it is pleasing to have the fact so frankly acknowledged by foreign printers.

The most important event in the electrical field is the convention of the American Street Railway association at Boston next week. This gathering would attract attention at any time owing to the importance of the interests represented, but the circumstances attending the meeting at Boston make it particularly interesting. The organization was formed in Boston in 1882, but at that time no one dreamed of the great expansion of the industry that has resulted from the efforts of the men associated in this society. The Western Electrician congratulates the association and its able officers, and expresses the hope that the organization may continue to improve and develop, and that its members may enjoy the results of their enterprise and ability.

Time has worked great changes in the electric-lighting business and the men engaged in that industry. Formerly it was customary for central-station men to line up as direct-current or alternating-current advocates, and fight everything and everybody that conflicted with their ideas. Nowadays a much more tolerant spirit exists. An example is furnished in the discussion over the general distribution of currents from central stations which occupied so much attention at the recent meeting of the National Electric Light association. Mr. Ferguson of Chicago, in opening his paper, in which he presented the merits of "direct current," said:

Nor do I wish to be construed as advocating blindly the general use of direct currents under all conditions for both transmission and distribution of electricity for lighting and power purposes in cities and towns.

Mr. Wagner of St. Louis, while supporting the views he had expressed in his paper as an "alternating-current" man, felt called upon to enter the following disclaimer:

I want it understood that I do not favor the use of the alternating current in every location and for every application.

It is too bad that central-station experts did not form similar views 10 years ago. However, the present tendency should be encouraged.

Electrical Engineering of Chicago, which has appeared at irregular intervals during the last five years under different forms and guises, has at least undergone a complete transformation, and, under new management, announces its intention to start in afresh. Heretofore it has bitterly assailed the independent telephone movement and has been regarded as a faithful interpreter, although an unofficial exponent, of Bell methods. The reception accorded these efforts was at no time particularly flattering, and, aside from such support as was extended by the Bell interests, the financial reward of those engaged in the publication was by no means encouraging. It is not to be wondered then that the management, failing to command recognition after many futile efforts, gave up the contest and withdrew.

Mr. C. E. Kammeyer, the new manager, hastens to announce that the enterprise is no longer controlled by the former owner, Mr. DeLand, and that the policy of the present management will be radically different. He takes particular pains, too, to emphasize the fact that the management has no connection with any telephone manufacturing, operating or selling company. Thus freed from all entangling alliances, Mr. Kammeyer announces his intention to follow the fortunes of the independent movement. The Western Electrician extends its sincere congratulations to Mr. Kammeyer personally, as well as in his capacity as publisher, upon his decision to discard the obnoxious policy of the former management of Electrical Engineering and follow the example of the Western Electrician in its advocacy of the independent telephone interests of the country.

It is worthy of note that nearly all of the equipment of the new electric railway in St. Thomas, Ont., was made in Canada. The fact is pointed out by United States Consul Burke, who says: "With the exception of the overhead joints and fixtures, which were purchased from the Ohio Brass company of Mansfield, the line was built and equipped with Canadian material, the total cost being $85,000. The rails were made at Hamilton, Ont., the engines at Amherst, N. S., dynamos and electrical equipment were bought of the Canadian General Electric company, Toronto, and the motors, eight in number, and two trailers were made by the Ottawa Car company." As the predonderance of the electrical and railway imports into Canada is purchased in the United States, the case of the St. Thomas Electric Railway company might well command the attention of American manufacturers if it indicates a well-settled industrial tendency, as it undoubtedly does to some extent. The Canadians are anxious to command their home market to the greatest possible extent, and inasmuch as we Americans have pursued exactly the same policy for years, and with success, we cannot blame our neighbors for following our example. No proud-spirited, inventive, energetic people can remain content merely to be farmers and fishers and miners, and in proportion as the Dominion extends its manufactures will its people be contented and prosperous. But in the case of the St. Thomas railway it is to be remarked that the dynamos and electrical car equipments were furnished by a company operating with American capital under American-owned patents. Thus much of the significance of the fact that this particular apparatus was made in Canada is lost.

All proprietors of large steam-power plants located in the centers of populous cities have to consider very seriously the smoke problem. The thick black smoke produced by the open and unrestrained combustion of bituminous coal is certainly a positive nuisance in large centers of population, and city authorities have sought, with varying degrees of activity and efficiency, to remedy the trouble. The volume and offensiveness of the smoke may be abated by either changing the fuel or modifying the processes of combustion in the furnaces. The latter method is generally adopted, as the cheaper one, and is the plan which will be followed in the interesting case of the Metropolitan Electric Supply company of London.

This company has been summoned on several occasions to answer to the charge of maintaining a smoke nuisance at its Amberley road station. The latest of these summonses came up for settlement in the Marylebone Police Court last month. The presiding magistrate decided that although the company might be compelled by statute to generate electricity, and at the same time prevented by circumstances from burning the so-called "smokeless" coal, it was still bound so to construct its furnaces that they should prevent "in the best-known way and under the best-known scientific principles" the emission from the chimney of more smoke than was absolutely necessary. It was clear that the company had not adopted the best means for preventing the nuisance. The magistrate understood that it would take nine months to make the necessary alterations, and he therefore made an order that the nuisance should be abated within that time, and he allowed the Paddington vestry, which was prosecuting, 20 guineas costs.

Mr. Bennett, the Police Court justice, took a commonsense and equitable view of the situation. Where central-station companies are forced to locate their plants in the "downtown" districts of large cities it is but just that they should avail themselves of the latest advances in the science of mechanical engineering to produce approximately perfect and smokeless combustion of their fuel, where the latter, as is so often the case, is of a nature to produce dense, billowy masses of black smoke. And there is the compensation that the efficiency of the whole plant is raised by bettering the work of the furnace and that low-grade fuels may be used to advantage.

Military Funeral for Electrician at Niagara Falls.

On Sunday, August 28th, Niagara Falls buried her first soldier of the Spanish war who met death in the service. The body was that of William Frederick Stricker, who was an employe of the Buffalo and Niagara Falls Electric Light and Power company and a member of the Electrical Workers' Union of the Falls. The young man was 23 years old on August 2d. He enlisted about the middle of May, at the time orders were issued to recruit companies up to their full strength. He became a member of Company E, Third Provisional Regiment, formerly the 42d Separate Company of Niagara Falls, and went direct from Niagara Falls to Camp Alger in Virginia. He was taken sick, and typhoid symptoms developing, he was transferred to Fort Myer, and there it was he died. The condition in which the body arrived at Niagara showed that he had been woefully neglected. There was dirt on his forehead and the marks of his fingers showed where he had endeavored to wipe his fevered brow. Not even a sponge had been applied to his face after death, and he died in the clothes in which he left home and in which the body was returned to his parents.

The funeral was one of the largest ever seen at Niagara Falls. The electrical workers of Buffalo, Tonawanda and other near-by places joined with men of the profession at Niagara Falls and attended the funeral in a body. The deceased, when he left home, was president of the Independent Hose company, and the firemen of Niagara Falls turned out to a man. From across the border in Canada came four fire companies with a band of music. When Niagara's soldiers marched off to war the Western

MILITARY FUNERAL FOR ELECTRICIAN AT NIAGARA FALLS.

Electrician of May 14th related how these Canadian firemen crossed to the New York state side to bid the American troops Godspeed. Their presence in the funeral cortege last Sunday told very plainly that they were willing to bear a portion of the country's sorrow. An electrician said: "They were with us in our rejoicing that our boys were called out, and now they are with us in our sorrow. Surely, they are true friends." The cortege, as it proceeded to the cemetery, was nearly a mile long, and in it the electrical workers had prominent place in the line. The 142d Separate Company was in line, and the deceased was laid to rest with military honors. Over the grave three volleys were fired and the bugle call was sounded.

The floral offerings exceeded in beauty and numbers anything ever seen at Niagara. The company of which the deceased was a member was represented by Lieutenant Mason and Private John J. Broughton.

The Patent Commission.

An act of Congress, approved June 4, 1898, provided for the appointment of three commissioners to revise and amend the laws of the United States concerning patents, trade and other marks, and trade or commercial names, which shall be in force at the time such commission shall make its final report, so far as the same relates to matters contained in or affected by the convention for the protection of industrial property, concluded at Paris March 20, 1883, the agreements under that convention concluded at Madrid April 14, 1891, and the protocols adopted by the conference held under such convention at Brussels in December of last year, and the laws of other nations relating to patents and trademarks.

The president has named as commissioners Judge Peter S. Grosscup of Chicago, Francis Forbes, secretary of the United States Trademark association and one of the United States delegates to the Brussels conference, and Assistant Commissioner of Patents Greely. The commission will hold its meetings in Chicago, and it is expected that it will convene some time during October. The law provides that the report of the commission, which will be laid before Congress during the next session, shall be so made as to indicate any proposed change in the substance of existing law, and shall be accompanied by notes which shall briefly and clearly state the reasons for any proposed change. It must also be accompanied by references to such treaties and foreign laws relating to patents and trademarks as, in the opinion of the commissioners, may affect citizens of the United States.

Interesting Storage-battery Discussion.

PART II.

Mr. Appleton: I think Mr. Hewitt leaves out the question of the time, which fixes the size of the battery. I know of several batteries being installed in this country, where the price has been between $60 and $80 per horse power on the short-hour rating.

Mr. Hewitt: I refer to a long-time rating.

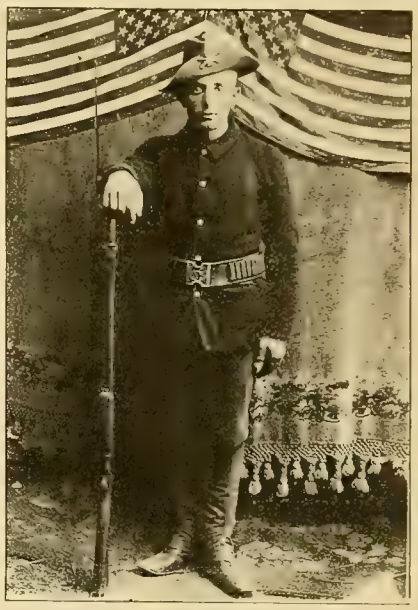
Mr. Appleton: It is not, I think, the practice to recommend batteries now where they will not be advantageous or profitable. There are plenty of opportunities for installing batteries where they will show to advantage.

Francis Schumann: What is the weight of a complete battery, ready for charging, that will develop 10 horse power for 10 hours?

W. W. Gibbs: About 100 pounds per horse power hour. I would like to add, in answer to the questions Mr. Hewitt has asked in reference to the reason storage batteries have made such little progress in this country compared with foreign countries: I think the reason was largely due to the fact of the litigation, which was almost constant from the time the first batteries began to be recognized as a feature of the electric industry of this country. Owing to this litigation, there was no inducement for any effort to effect a development of the secondary battery. The few installations made were defective, and the men who went to the expense of installing even a defective battery did it under a liability to litigation. It was down to 1894 that this litigation continued. While I do not take any special credit, I think it will be recognized by those familiar with the subject that it was through my efforts that the litigation was brought to a determination, and at an enormous expense, and the storage-battery business has not yet recovered from it, and we are not yet in a position to do as Mr. Hewitt intimates could be done, namely, reduce the price of storage batteries. I want to say, however, that we have got it to a point where we can put it where all other businesses have to be put—where supply and demand will regulate the price. I venture to say, those who started in the electrical business early thought the rates paid for the dynamos four, five or six years ago were high—much higher than they are to-day—and a much inferior article then was obtained. We were recently asked by a large concern what we would furnish storage batteries for, and we gave them a price on $1,000,000 worth of batteries 50 per cent. less than we would have made $10,000 worth for. We are endeavoring to educate the country as to the usefulness of storage batteries, and this course cannot be adopted without great expense. In 1894, immediately following the determination of this litigation, we made every possible effort to induce people to take up storage batteries, and we spent the first year $40,000 more than we received, although we got a high price, as Mr. Hewitt or anybody else will admit, for the batteries. We are getting down the price, however, and we believe during the coming year we shall be able to reduce the price and give the fraternity a battery which will give entire satisfaction. And it only needs appreciation on the part of people who are producing electric-power plants and giving us generous support by buying what they can advantageously employ to get storage batteries very cheap. The best evidence that they can afford to buy them is that the cities where the greatest amount of storage batteries have been bought are buying more. In Boston they have bought many, in New York and Brooklyn also. It is only those people who find storage batteries beyond their reach that do not know the advantages to be derived from their use. There are many advantages that you cannot appreciate until you try them, and these advantages are apparent even at present prices. If there is a general effort to apply them where they can be employed, it will be but a short time only before storage batteries will also be considered cheap.

Mr. Salom: I think I can answer some of these questions from my experience in New York. We found at our station in New York that the best man to run a motor carriage is the ancient hackman. We started in with young men who had more or less training in practical electrical engineering, thinking we were going to improve the personnel of the service by having educated drivers, but we soon discovered that the hackman's business is a profession. They have to know all about the city and how to go everywhere, and it is not every man you pick up who will meet the requirements. As to the matter of running the machine, it is a simple thing. A man can learn to run it in a week, or not at all. The wagon can be driven in places where one would not dare to go with a horse, and with greater speed. You could not find a worse place than Fifth avenue and Forty-second street, especially a year ago, when the pavement was torn up. I have seen our drivers go through there and push their wagons wherever there was a chance to get them in, and do it skillfully and without accident. As to accidents, that is a question that can largely be settled by careful inspection. Of course, accidents occur and do occur all the time, but by systematic inspection they can be reduced to a very small number. We started in operation in New York on the 27th of March, and in the month of June last year we ran 4,600 miles. In that distance we only had six delays or accidents of all kinds. The question of the battery giving out is the most serious one. If a wheel breaks or anything of that kind, you can telephone to the station and get another. But the battery giving out is a more serious problem. We have always insisted, however, that none of the wagons shall be pulled home by a horse. So when the driver has to push his machine home, he does not often get left.

The tire problem has been serious, except so far as punctures are concerned. I think we have not had more than two punctures in 50,000 miles. The other troubles are because the tires were not adapted to the service. The cab service in a city like New York is very severe. The irregularities in pavements, railway tracks, etc., render it, in my judgment, almost impossible to use anything but a pneumatic tire. Of course, it is true that a solid rubber tire requires less power on a smooth pavement than a pneumatic, and a steel tire would require still less than a solid rubber. We require a little over twice as much power to run a vehicle with pneumatic tires as is required on a rail, for the same weight and speed, and the criticism, therefore, that one of the gentlemen made about pneumatic tires is not a just one, unless you take all the factors into consideration. They are very expensive;



WILLIAM FREDERICK STRICKER.

but we think, now, with the five-inch tire we have adopted for the weights we have to carry, we expect to get 20,000 miles out of a tire, at which rate they will compare with a steel tire. When you think of a bicycle—only weighing 20 pounds, and 200 pounds with its rider—requiring a 2½-inch tire, it is not unreasonable to expect that vehicles weighing 4,000 pounds, and required to go at the same speed, should take a five-inch tire. It looks awkward at first, but not more so than when pneumatic tires were introduced on the bicycle. And as to the question of taking more power with a pneumatic tire than with a solid tire, the former has advantages which render its use almost indispensable. Experiments have been made which proved conclusively that a pneumatic tire is the proper thing, other things being equal.

The president: A thought suggests itself in relation to the operators of the carriages, whether they are called hackmen or not. It is a question as to what class of skill is required to successfully operate an electric carriage. It is a more complex piece of mechanism than a hack or a horse, where, if one or the other breaks down, you can get back in some way. But if an electric vehicle breaks down at a remote distance from a station, a serious difficulty arises.

Mr. Schumann: How many hours will a battery retain its full function when not in use?

Mr. Appleton: With the present class of battery it would hold for a considerable time. It depends entirely upon the purity of the materials used, so that no local chemical action can take place while it is standing. We let batteries stand two or three months after being fully charged, and there is a loss of only two or three per cent., which is entirely due to impurities in the materials.

E. A. Scott: I was asked to see a storage battery within a few days, and was assured positively that it had not been charged for 13 months. It gave full two volts to every cell, and that with a half-dozen lights burning.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Telephony for Large Cities.

By H M. Fisk.

The greatest drawback the independent telephone companies experience is their inability to furnish long-distance service to the large cities, and until the large cities have independent exchanges the long-distance service must of necessity continue in a measure unsatisfactory. Chicago is by far the most important of the large cities to the interests of the independent companies.

With a large independent exchange in Chicago, connected by long-distance lines to the towns throughout the country, the Bell Telephone company would only exist as a dreadful nightmare in the minds of the many business men who have been compelled by force of circumstances to patronize it during the last 20 years.

Let us first raise the curtain and see what we must contend with in forcing such a fight.

The first thing to be considered is the demand for telephone service, and by a few comparisons I think it will become apparent that most of our little towns, in proportion to their population, have on an average of from four to five telephones where Chicago has but one under the present Bell management. The only explanation for this condition is the cost. If placed at a reasonable figure there should be at least 30,000 subscribers in Chicago instead of the comparatively small number at present furnished by the Bell company.

Chicago has between a million and a half and two million inhabitants. It has less than 15,000 subscribers or less than one telephone for each hundred persons. There are many towns of 1,000 inhabitants that are supporting an exchange of 100 subscribers, or one instrument for every 10 inhabitants. Other towns of 6,000 to 8,000 support exchanges of 200 to 300, or a telephone for each 20 to 30 inhabitants. The time is coming when we will find a telephone wherever we find five people, or an average of one for every household, but not while they have to pay from $100 to $300 per year for the service.

Why is this excessive charge made by the Bell telephone interests? Is the Chicago Telephone company making too much money or is the fault in the way the business is handled? And can it be remedied? In order to bring the matter directly home I will ask if an instance is known where a plant of the magnitude of the Chicago Telephone company has been built piece by piece, as the exigencies of the moment demanded, that was capable of economic operation? That is the position of the Bell interests to-day. Their exchanges are scattered throughout the city, some ten or a dozen in number, each with a general operating expense nearly equal to the general operating expense of one large office, capable of handling the business of three times the number of subscribers these branches serve. There is for each of these offices a manager, night manager, chief operator, assistant chief operators, relief chief operators, wire chief, switchboard man and repair man, matron and janitor. For the entire city it requires something like 500 operators, 25 per cent. of whom are trunking operators, and it requires quite an army of men to take care of the troublesome Blake instruments which have become so familiar to all of us.

One of the primary reasons advanced for scattering exchanges has been the expense of a single central. As a matter of fact the expense of carrying these trunk lines between the several exchanges, together with the expensive trunking equipment, is much more than enough to warrant bringing all the lines into a central exchange. Another reason given for not bringing all the lines into one central exchange is that they cannot be handled; from 5,000 to 6,000 is the maximum capacity of a multiple board, and the divided boards used by the Bell companies are not efficient for handling large numbers with economy in one exchange. Then, too, the subways were crowded before they really began, and should they desire a reform it would be necessary to throw away all they have built and commence anew.

Now, let us look at the work required of these operators and managers. During an average day in this great metropolis about 250,000 people are communicating, or it may perhaps be more exact to say that 125,000 calls per day are responded to by the operators. Of this business perhaps 60 per cent demands some attention from two to five operators, and each time the calling operator must wait until the operator called for is at liberty. I presume many readers have waited what seemed to them an hour before they talked to the subscriber they called for. Of course it was not such a long time as it seemed, but it sometimes consumes several minutes, and the experience is both annoying and vexatious. How much better would patrons feel could they call for a number and feel assured that the minute the response was made their bell would ring.

I realize the magnitude of the task of constructing an ideal exchange for a city like Chicago, but I will submit a rough outline on paper and ask an unbiased examination of it. First, after a careful examination, I would select the most desirable point for an exchange and have a series of subways constructed capable of receiving, say, 50,000 wires in 100-pair cables. Over the subway I would build a perfectly fireproof building, at least 100 feet square and preferably a third larger, for the sole purpose of handling the entire business of the company. In the two upper floors there would be the operating rooms. Each operator would have a board to which would lead the lines of 100 subscribers. This board would be constituted of the following items: One hundred subscribers' drops, 10 pairs of plugs and signals in multiple of 10 for each operator in the exchange. These signals would be carried in multiple to each operator. For each signal I would have a trunk line, separate and distinct from everything. There would also be a registering device controlled by each other operator.

In operation we will say No. 350 wants No. 750. When No. 350 rings for central, the No. 50 drop falls in front of operator No. 3. No. 3 signals No. 7 to connect trunk 30 to 50. When No. 7 does as desired the action rings both parties and connection is complete without any exchange of greetings between operators and wasted time. Suppose, however, that No. 750 is busy. No. 350 may sit down until No. 750 is free, when the call is completed. No time is wasted by No. 3 operator waiting for No. 7 to come in on the line to receive her verbal instructions. While No. 7 is completing the connection No. 3 is at liberty to look after other calls.

Instead of having 10 offices to manage, I would have only one; instead of an operating expense of $800,000 or $900,000. I would have not more than $150,000; instead of each subscriber costing from $70 to $80 annually, he would cost about $15; instead of subscribers paying from $125 to $250 annually, the residence subscribers would pay $50 and the business man $75; instead of the Blake transmitter I would have the most approved type of long-distance instrument; instead of discontent and grumbling on the part of subscribers I would have smiles and good cheer.

I am confident we do not need to wait for the millennium for these results. All that is necessary is to attack the problem with a will, and the battle is ours.

A Telephone Incident of the Campaign in Porto Rico.

In war it is sometimes the part of wisdom to establish means of communication and sometimes the wiser plan to destroy those existing. Neglect of the latter precaution and indiscreet chaffing with the enemy over a telephone line brought on a lively encounter at Cape San Juan in the Porto Rican campaign. During the first week of August a squad of sailors captured the lighthouse at the cape, which is the northeastern extremity of the island of Porto Rico and about 32 miles east of San Juan, the capital city. When the American sailors took possession of the lighthouse the old keeper and his wife professed to be glad to welcome them. Asked if there was any means of communication with the capital city of the island, the keeper pointed to a telephone, to which a Chicago boy from the Amphitrite promptly walked, and ringing the operator at the other end, informed him in indifferent Spanish that the light was in possession of the Americans and that he and his companions would call in the city within a few days. It was a good joke, but, unfortunately, the line was not disconnected, and through its medium the authorities at San Juan were advised that the entire garrison consisted of but 40 sailors armed with carbines. Nothing more was thought of the incident, and the day after the landing half a dozen seamen visited the near-by town of Fajardo, which promptly surrendered, the alcalde hauling down the Spanish flag and the "jackies" raising the stars and stripes. But the telephone and telegraph wires were working, keeping the commandant as San Juan advised. The upshot of this carelessness on the part of the Americans was that a column of 800 men was dispatched against the invaders. The Spanish soldiers easily recaptured Fajardo and hauled down the American flag. Then they advanced toward the lighthouse. A sharp engagement ensued, in which, thanks to the guns of the Cincinnati, Amphitrite and Leyden and reinforcements from the ships, the Spaniards were forced to retreat with loss. But the naval officers decided that it was wise to withdraw from the lighthouse, and the light was extinguished. So the telephone demonstrated its value to friend and foe alike.

Clergyman Sues Telephone Company.

The Rev. F. M. Moore of Hagerstown, Ind., a minister of the United Brethren Church, has brought suit against the Central Union Telephone company for $2,500 damages. The complaint is made that the company became party to a practical joke by delivering a message in which the Rev. Mr. Moore was solicited to visit Falmouth, Ind., to preach a funeral sermon. After receiving the message the complainant went to Falmouth, but, upon arrival there, found that the information conveyed in the messages was erroneous and that there was no funeral in that part of the county. On account of the levity indulged in at his expense by persons who learned of the peculiar mistake, the minister was subjected to great annoyance.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Keystone Telephone company of Pittsburg has established a distributing agency for the western states in Des Moines, Ia., in charge of C. W. Bartlett.

The Iowa Association of Independent Toll Line Telephone Companies has abolished its system of charging toll messages based on the number of counties through which the message passed and has substituted a rate based on the mileage. There were 13 companies represented at the meeting. The matter of consolidating the lines into one company will probably be acted on finally at the winter meeting of the association.

The Wayne County Telephone company at Clio, Ia., declared a 10 per cent. dividend on the last six months' business.

The Iowa and Nebraska Telephone company is building rapidly from Cherokee, Ia., toward Sioux City.

The Iowa Telephone company is canvassing Humboldt, Ia., with a view to establishing an exchange there.

The Iowa Telephone company has extended its connections in the vicinity of Wapello, Ia., to a number of the smaller towns.

The telephone company now has connection between Ellendale, N. D., and Ludden, Monango and Oakes.

The lines of the Northeastern Telephone company have been completed to Green Bay, Wis. The Reedsburg Telephone company has been granted a franchise for an exchange at Reedsburg, Wis.

The Spring Valley Telephone company expects to have the local exchange in Spring Valley, Minn., in operation by September 20th.

The Dakota Central Telephone company of Aberdeen, S. D., has completed its construction work in the northern part of the state, and confidently expects communication with Minneapolis and St. Paul before long. The company will now push construction in the southern part of the state.

A telephone line is being constructed between Hartford, Wis., and Jackson.

The telephone system at Plymouth, Wis., is not exactly satisfactory, and measures are being considered for improving it.

The Iowa and Dakota Telephone company has let the contract for the construction of a line from Alcester, S. D., to Sioux City, Ia., via Alton, Le Mars, Hawarden and Orange City.

The Northwestern Telephone Exchange company is preparing to rebuild its St. Paul exchange in the same manner as the Minneapolis system has just been arranged. A new building for an exchange will be erected for the Laurel avenue exchange, at a cost of $9,000 and one at Cedar and Fifth streets, to cost $15,000. The improved switchboard, eliminating ringing of a bell to call central, will be put in. The entire expenditure will amount to about $150,000.

The Cedar Valley Telephone company has opened exchanges at Disdale and Dysart, Ia., recently.

The Slaughter-Waterman company of Hiteman, Ia., has built a telephone line from Hiteman to Bussey, Ia., and intervening towns.

The Perry Telephone company is preparing to establish an exchange in Stuart, Ia.

The Iowa Telephone company will build a line from Laurens, Ia., to Marathon, Ia.

The new telephone exchange at Dennison, Ia., opened with 55 subscribers.

The Central Telephone company is building a line to Oskaloosa, Ia.

The Wisconsin Valley Telephone company will replace the common wire on its long-distance line to Ashland, Wis., with copper wire and will remove the line to the C., St. P., M. & O. railway right-of-way. An exchange is being established in Ashland also, and it is expected that it will have about 350 instruments.

F. B. Forbes, proprietor of the telephone exchange at Albert Lea, Minn., was stricken with apoplexy, and for a time it was supposed that he had died. He rallied later and has since showed evidence of improvement.

C. C. Lashway of Chippewa Falls, Wis., has been transferred to the management of the Wisconsin Telephone company's office in Menomonie, Wis.

The Galena (Kan.) Telephone company will have poles on the ground for a subscribers' line from Galena to Girard, Kan., by way of Columbus, Weir City and Cherokee soon.

H. M. Kellogg has secured the contract to equip the telephone exchange at Mankato, Minn., for the Mankato Citizens' Telephone company. The Stromberg-Carlson instruments will be used, and the system is to be ready in 90 days. It will cost about $7,000.

The Moravia Telephone company of Moravia, Ia., will extend a line to Seymour, by way of Centerville and Cincinnati.

Cuban Telephone Service.

Maps and charts have been prepared for a military telegraph and telephone service between Santiago, Guantanamo, Baracoa, Sagua de Tanamo and San Luis, all garrison points, and Captain Leigh will begin the work of stringing the wires as soon as he reaches Santiago.

Mechanicville Electric Power Transmission.

The development of the power at St. Anthony's Falls on the Mississippi at Minneapolis, Minn., is followed closely by the utilization of the power of the upper waters of the Hudson River at Mechanicville, N. Y., where an undertaking of no less magnitude has just been completed. Between 5,000 and 7,000 horse power is available at the power house,

FIG. 1. MECHANICVILLE ELECTRIC POWER TRANSMISSION.—BEFORE DEVELOPMENT.

and the use of high-tension current permits of its distribution over a wide territory.

Early in 1897 the attention of R. N. King, president of the Stilwell-Bierce & Smith-Vaile company of Dayton, O., was drawn to this water power. The site is only two miles from Mechanicville, 11 miles from Troy and 18 miles from Albany. But most important of all, it lay only 17 miles from Schenectady, where, covering 130 acres of ground, the largest electrical works in the world, are operated from an extensive steam plant with which the electrical power from the Mechanicville cataract could

FIG 2 .MECHANICVILLE ELECTRIC POWER TRANSMISSION.—UPSTREAM SIDE OF POWER HOUSE WITH FOREBAY.

readily compete. Accordingly the Hudson River Power Transmission company was formed and the hydraulic engineering was superintended by A. C. Rice, chief engineer of the Stilwell-Bierce & Smith-Vaile company. As the General Electric company was to purchase the largest amount of power, its advice as to the electrical equipment was naturally closely followed.

At the point chosen for the hydraulic development, shown in Fig. 1, the banks and bottom of the river are of rock, as is Bluff Island, which divides the Hudson into two channels, and here, during the greater part of the year, water is sufficient to produce from 7,000 to 10,000 horse power.

The power house starts from and extends out into the river about 215 feet and is connected with Bluff Island by a concrete dam, 26 feet above the bed of the river, 10 feet wide on top and 18 feet wide at the base. The upstream face (Fig. 2) is vertical and the downstream face sloping. The dam is provided with four arched waste gates four feet wide and six feet nine inches high, operated in the same manner as those in the main dam.

The main dam, Fig. 3, is built entirely of concrete, 16 feet high above the river bed, eight feet thick immediately below the crest, 16 feet thick through the base and 30 feet thick through base and apron. It is set between massive abutments anchored to the rock sides of the river bank and island. The eastern is 20 feet long, 26 feet high over river bottom, 16 feet thick at the top and 34 feet wide at the base. The western abutment is 100 feet long, the other dimensions being similar to those of the eastern abutment. The length of the spillway between abutments is 800 feet. In the western abutment are 12 arched waste gates of ample proportions. Each gate is four feet wide and six feet high, and is opened and closed by a heavy iron hoist operater by rack and pinion. The eastern dam is practically a solid rock wall, capable of safely resisting any flood. To prevent any floating rubbish, ice or logs reaching the rocks or choking the waste gates, a floating wooden boom stretches from the western end of the spillway diagonally for a distance of 400 feet, to the edge of the normal river bank, and then for a distance of 1,000 feet, to the main embankment of the Mechanicville highway. It is anchored to a line of stone-filled cribs.

The power house lies between the west bank and the short concrete dam, nearly filling the space between the island and the west bank of the river. It is practically a continuation of the dam, and, like the main dam, is of concrete, with the exception of the upper walls. Its construction is of the most substantial character, the foundations are carried down to the bedrock, and the house is carried on heavy steel box-web girders resting upon steel I-beam columns. The latter are embedded in concrete walls carrying arches which form the floor of the generator room and the floor on which the wheel flumes rest. The walls form a separate and distinct tailrace 22 feet wide for each set of turbines, from which the water may be shut out at will.

FIG. 3. MECHANICVILLE ELECTRIC POWER TRANSMISSION —MAIN DAM AND WASTE GATES

The plan of the power house is shown in Fig. 4, and the side elevation looking upstream in Fig. 5. It will be seen that the house is divided into two parts by a thick head wall. The upstream part contains wheel chambers for seven 1,000 horse power wheels, of which five only are at present occupied. The downstream portion contains the wheel governors and the electrical apparatus. The length of the power house proper is 257 feet six inches, the width of the dynamo room between head wall and south wall 34 feet, and the width of the wheel-chamber portion 32 feet six inches. The total width of the power house is 66 feet six inches. At the western end an L-extension runs upstream 87 feet five inches long and 44 feet 10 inches wide. This portion of the power house is of brick. A retaining wall runs downstream from the power house along the western bank a distance of 50 feet. The western stream, running between the bank and the island, forms the forebay, 300 feet long. The main tailrace is 205 feet wide and joins the main stream 750 feet below the power house.

Arched chambers are provided for seven main wheels and two exciter wheels. Each main chamber is 32 feet six inches long, 22 feet wide and 17 feet five inches high and is provided with two six-foot manholes. Each exciter-wheel chamber is 32 feet six inches long, 17 feet five inches high and 10 feet wide. The head wall of the chambers is six feet thick, the wall on the upstream and both sides three feet thick. In the head wall of each main chamber is set a heavy cast-iron cover through which the turbine shaft passes in a water-tight packing box, carrying the ring-oil bearing for the shaft. The saving in space effected by the new arrangement of housing and coupling together of the turbines, patented by the Stilwell-Bierce & Smith-Vaile company, has tended to diminish considerably the size of the power house.

A 20-ton crane, from the works of Pawling & Harnishfeger, Milwaukee, runs the entire length of the dynamo room.

In front of the wheel chambers, and running the entire length of the power house, is a raised trash rack of steel bars supported on a framework of steel channel and I-beams. This rack effectually prevents the access to the wheels of any rubbish or floating material that may escape the boom.

The main wheel plant consists of 10 pairs of 42-inch horizontal Victor turbines of the latest type built by the Stilwell-Bierce & Smith-Vaile company of Dayton, O. Each main turbine consists of two pairs of wheels which, at the normal speed of 114 revolutions, is rated at 250 horse power. The total power of each set of turbines is, therefore, 1,000 horse power. Five units are now in position. The two additional turbines will be installed shortly. The head under which the water wheels are operated is 18 feet.

The turbines for the exciters consist of three 18-inch Victor cylinder gate wheels, having, at 250 revolutions per minute, a total of 300 horse power. The quarter-turns and packing boxes of these wheels are brought through the wall beneath the station switchboard.

Two draft tubes lead from each main turbine, the forward tube descending straight into the tailrace beneath the power house, the rear or upstream tube curving and flaring downward and outward. Each tube is nine feet six inches in diameter at the bottom. Two draft tubes are also allotted to each set of exciter wheels, the setting following a similar arrangement. The rear tube is four feet in diameter, the forward tube three feet.

The speed of each set of main wheels is regulated by a Geisler electro-mechanical governor, mounted on a platform directly over the turbine shaft, and between the head wall and the generator.

The governors controlling the exciter-wheel gates are improved "Snow" governors, which rapidly bring the speed to normal when changes are neither frequent nor heavy.

By reference to Fig. 6 it will be readily understood that the dynamo room is a spacious chamber well lighted by windows on all sides. It is 255 feet long and 34 feet wide, 30 feet five inches in the clear from floor to roof truss, and 22 feet from floor to crane. The ultimate generator capacity of the station is 7,000 horse power in seven units. Five have been installed and are now running. They are unitooth, three-phase, 40-pole, 750-kilowatt, 114-revolution alternating-current machines, having revolving fields and stationary armatures, and wound to deliver 36 amperes of current at a periodicity of 38 cycles and a pressure of 12,000 volts to the transmission lines. The alternators are similar in their main characteristics to those successfully used in the development of the power of the Lachine Rapids as Montreal. The armature frame or ring is of the box type, 15 feet four inches in diameter and 36 inches wide. It is bolted to a base 18 feet two inches long by 10 feet wide, along which it may be moved parallel with the shaft, in order that the revolving-field spiders and poles may be uncovered should occasion arise. The armature winding is protected on each side by iron shields. The pillow blocks are also bolted to the base and the bearings are of the spherical-seated, self-oiling type. The field ring is bolted to the spokes of the spider. It carrires 40 poles, each securely fastened by two bolts to the ring. The whole revolves on a shaft 15 inches in diameter provided with a rigid coupling on the turbine side bolted to a similar coupling on the turbine shaft. The dynamo shaft is extended for coupling to a vertical steam engine in case of necessity.

The exciters are placed on each side of the stairway leading to the switchboard gallery. They are six-pole, 100-kilowatt, 125-volt standard General Electric machines with ribbed field frame and iron-clad armatures.

The switchboard, erected on a gallery on the north wall of the dynamo room, is built up of nine

highly polished panels of blue Vermont marble, each panel seven feet six inches high, three feet wide and two inches thick. Of these nine panels five are used for the generators and two for the feeders; one is the total-output panel and the last is for the control of the exciters. The generator panels occupy the left side of the board, and room on the gallery is left for two additional panels. The feeder panels are on the right side; the total-output panel is between these and the generator panels, while the exciter panel is the third panel from the left-hand end of the board.

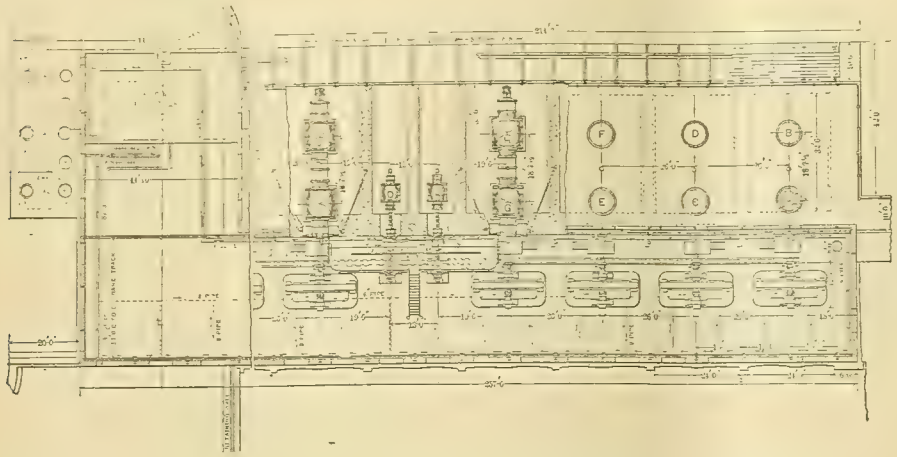


FIG 4. MECHANICVILLE ELECTRIC POWER TRANSMISSION.—PLAN OF POWER HOUSE.

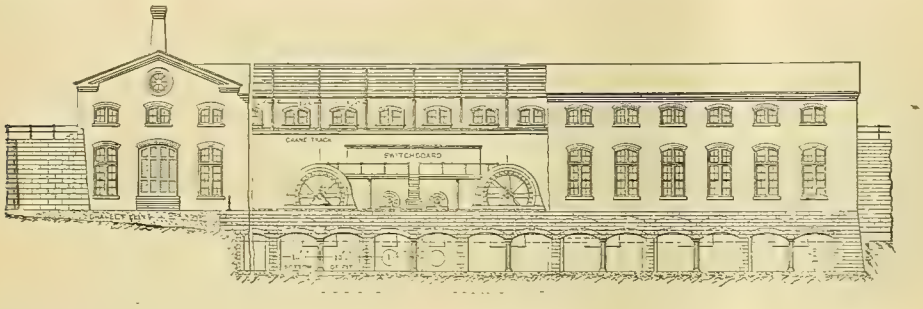


FIG 5 MECHANICVILLE ELECTRIC POWER TRANSMISSION.—SIDE ELEVATION OF POWER HOUSE LOOKING UP STREAM.

Each generator panel is equipped with the following instruments: One inclined-coil alternating ammeter reading to 75 amperes for the generator, and one direct-current ammeter reading to 150 amperes for the field. Above each of these is a pilot lamp and between the pilot lamps are synchronizing lamps. Beneath the two ammeters is an inclined-coil voltmeter reading to 15,000 volts, and beneath this instrument are three single-blade, double-throw, quick-break, high-tension switches, each mounted upon pyramids of corrugated hard rubber. Similar pyramids intervene at the back of the board between the bus-bars and the board. As these switches are to break current of 12,000 volts, they are tested to break, without difficulty, currents of 21,000 volts. The switches are without handles. An eye is made in the end of each blade into which a hook at the end of a stick may be inserted and the switch opened by the attendant from a safe distance. Further, to prevent any dangerous arcing from blade to blade, marble barriers 1¼ inches thick, three inches long and 12 inches wide from the face of the board are erected between the blades.

On the left-hand side of each generator-panel subbase are two 100-ampere, double-pole, double-throw carbon break switches—one the field switch, the other the lighting switch. On the back of the panels are the high-tension fuse blocks. These fuse blocks, designed for 20,000 volts, are of the snap-break expulsion type. The field rheostats are hung beneath the gallery, and are operated by hand wheels on the gallery and bevel gears below it.

The exciter panel, controlling the two direct-current exciters, carries two pilot lamps, two circular dial ammeters, each reading to 1,000 amperes, one voltmeter reading to 150 volts, one four-point pressure switch, one synchronizing switch, two 800-ampere, triple-blade, double-throw equalizing switches and two packed-card rheostats.

The two feeder panels are similar in every respect. Each outgoing line is provided with an independent ammeter reading to 150 amperes, and a quick-break, double-throw, high-tension switch, similar to those on the generator panels, and similarly mounted on the board. Mounted also on corrugated hard-rubber pyramids are the six circuit breakers or automatic plunger switches. These high-potential plunger switches consist simply of long copper rods sliding in hard-rubber tubes. On the upper part of each feeder panel at the back is a current transformer for each outgoing line, two recording single-phase wattmeters, each reading to 25 amperes and 12,000 volts, and two potential transformers.

On the front of the output panel are two Thomson recording wattmeters for balanced three-phase circuits, each reading to 300 amperes and 12,000 volts, and 12 triple-pole, single-throw, 100-ampere switches with fuses for the lighting circuits. On the back are four potential and two current transformers.

The lightning arresters are of the G E short-gap type. The line is protected by double-pole 2,000-volt arresters connected six in series to give the necessary number of spark gaps. There are three sets of these—one at Mechanicville, grouped around the first transmission pole in a small house 15 feet square, one set on the Schenectady side of the Glenville bridge, where the overhead pole line connects with the underground cable, and the third at the General Electric Works.

The lead-covered leads from the generators are taken out at the base of the machine and are laid in ducts in the floor. Rubber-covered wire is used for the field connections. The line from Mechanicville to Schenectady consists of three No. 000 B. & S. band wire, this large gauge being employed in order to give the line as high self-induction as possible. The circuits are carried on poles 30 to 60 feet long, and all eight inches in diameter at the top. Each pole carries one cross-arm, on one side of which are two porcelain insulators of the triple petticoated type, a third being on the other side. For lightning protection a barbed wire, frequently grounded, runs along the tops of the poles.

The introduction of this transmitted electrical power into the factory of the General Electric company will work a considerable change. At present all the machinery is driven by electric motors, while the testing department demands an independent supply of current for the work it carries on. There are at present, therefore, two distinct generating plants. The electric power plant, superseding the present steam plant at the works, will consist of two synchronous motors, one of 500 kilowatts, the other of 100 kilowatts and three 400-kilowatt rotary converters—the synchronous motors for the testing department, the converters to supply current to the factory motors.

The construction of the dams, power house and lines was undertaken by the National Contracting company of which G. M. Furman is general manager, E. A. Mathews superintendent, and J. A. Leonard constructing engineer. The electrical equipment was furnished by the General Electric company and the hydraulic equipment by the Stilwell-Bierce & Smith-Vaile company of Dayton, O., which also had charge of the entire development contract.

The officers of the Hudson River Power Transmission company are: General Edward Hayes of Buffalo, president; R. N. King, president of Stilwell-Bierce & Smith-Vaile company of Dayton, vice-president; G. M. Furman of Newark, treasurer; E. J. Richards of Boston, superintendent, and J. S. O'Shea manager.

Signal Service Balloon.

The balloon used by the Signal Service Corps in the military operations before Santiago will be exhibited at the Omaha Exposition and afterward stored at Fort Omaha. The exhibit will include the generator and gas compressors used at Santiago, and will be in charge of a detachment of the Signal Corps, commanded by Colonel H. C. Dunwoody. Ascensions will be made daily. The balloon was secured for the exposition mainly by the efforts of Edward Rosewater.

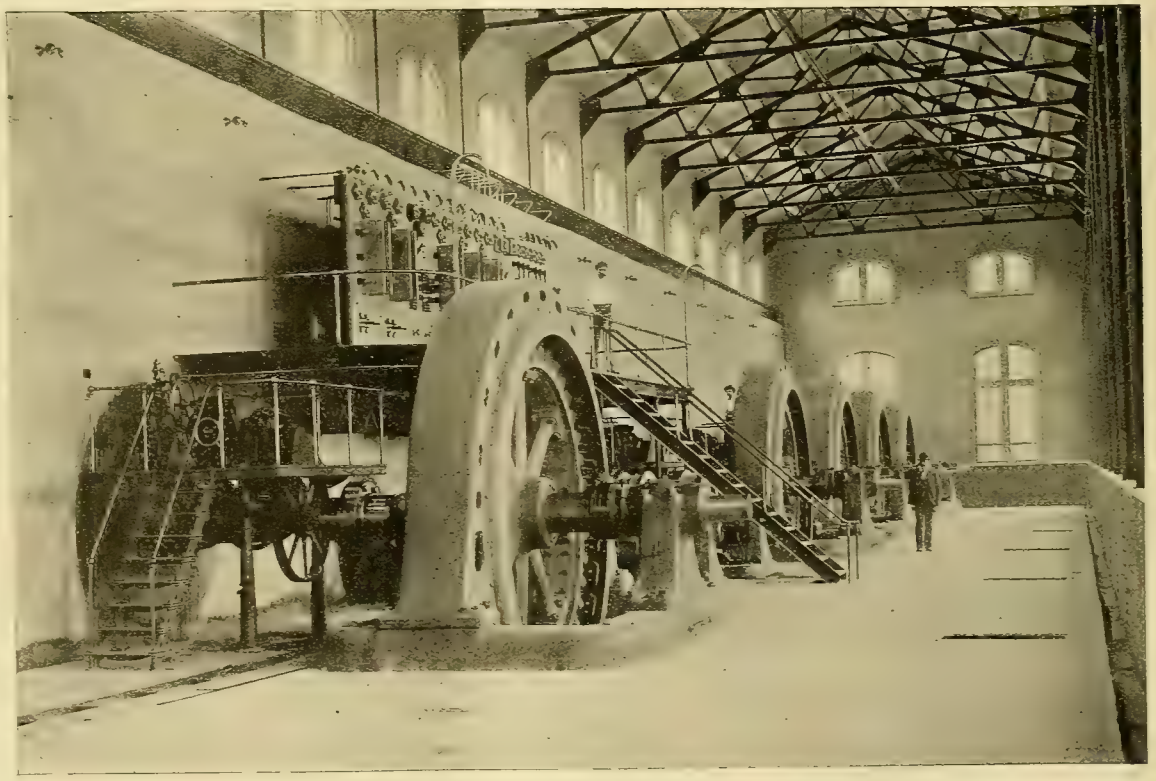


FIG. 6. MECHANICVILLE ELECTRIC POWER TRANSMISSION.—INTERIOR OF POWER HOUSE; DYNAMO ROOM.

Auxiliary Fire Protection.

At the recent convention of fire-alarm superintendents in Elmira much attention was attracted by the heat-sensitive electric cable of the Montauk Multiphase Cable company of New York, in conjunction with the Gamewell auxiliary fire-alarm apparatus. A committee consisting of William Brophy of Boston, M. W. Mead of Pittsburg, George F. MacDonald of Ottawa (Ont.), F. C. Mason of Brooklyn and W. N. Thompson of Richmond reported on this new combination for fire protection in the following terms:

"We find properly located and connected up one fire-alarm box, arranged so as to be operated from an auxiliary sub-station; also the proper arrangements and connections for automatically sending in an alarm of fire by means of multiphase cable, a fusible wire being burned through or cross-connected by contact with a slight blaze or fire, such as a match might cause. On the application of a very slight fire from a match the multiphase cable was cross-connected, thus throwing on an additional current of electricity, the composite wire was melted, thus opening properly another line, relieving a light current which had previously been in operation. By these simple means the main box was pulled, the alarm struck on a local gong attached to the circuit; a warning bell rang to indicate that the line was in operation, and the instantaneous sounding of the alarm showed that all claims as to the merits of the purpose and operations of the apparatus had been fulfilled. It is simple in action and reliable as a fire-alarm adjunct. The Montauk multiphase cable is practically a substitute for a thermostat, and this cable, being run in out-of-the way places or in dangerous localities in buildings where fire is liable to occur, really makes a continuous thermostat, ready at all times for action in case of fire or dangerous heat at any point where the cable runs."

The subject was also considered in a paper entitled "A Great Advance in Fire-alarm Telegraph Protection," read before the association by J. W. Aydon, superintendent of fire and police telegraphs at Wilmington, Del., who is now the president of the organization. The following is a condensation of Mr. Aydon's paper:

I desire to present to the convention a brief description of a most important and recent advance in methods of fire-alarm protection, which will make the outbreak of a fire and the sounding of the alarm through the municipal system practically simultaneous.

I refer particularly to a combination with the well-known Gamewell auxiliary fire-alarm system and the cable of the Montauk Multiphase Cable company, which combination makes the Gamewell auxiliary system automatic as well as manual.

The auxiliary system, in effect, brought the nearest public fire-alarm box into the interiors of buildings, and placed it at any desired number of points, by providing a series of small auxiliary boxes, from any one of which the street box could be instantly operated, by the pulling down of a lever contained in each auxiliary box. But the system, being purely manual, was not effective when the protected premises were vacant; and it was to cover this point that the method of rendering the auxiliary system automatic as well as manual was perfected.

The growth of the automatic system, however, has necessarily been confined to a few of the largest cities, for the reason that it is necessary to maintain the system in connection with its own central office, through which alarms of fire have to be transmitted to the fire department. The expense of wiring and the cost of maintaining a central-office equipment are so great that the business cannot be made a commercial success, except in the largest cities.

The successful operation of an automatic system in smaller places is now, for the first time in the history of fire telegraph, possible. It has never been a matter of electrical or mechanical difficulty to connect ordinary thermostats into an auxiliary system so that an excess of heat would automatically operate the street box, but the danger of unnecessary alarms has prohibited this.

The recent invention of the Montauk "multiphase" cable, referred to above, has been adapted for use in connection with the auxiliary system, so that it becomes automatic as well as manual without the sacrifice of any of the peculiar features of safety from false alarms, which is the foundation of the willingness of fire departments to allow its use in connection with street boxes.

This "multiphase" cable is of peculiar construction. Briefly, it consists of a copper conductor having a fusible metal covering, with insulating material over it, around which is wound a series of small copper wires, the whole being again protected by a slow-burning insulation. This cable is wired into the auxiliary system in the place of the ordinary wire heretofore used, and in connection therewith is run a single wire composed of fusible metal only, and protected with a free-burning insulation.

An automatic auxiliary equipment would, therefore, consist of the desired number of auxiliary boxes, distributed throughout a building at convenient locations, connected through the usual testing apparatus with the nearest street fire-alarm box. The interior wiring of the equipment would be of this "multiphase" cable described, and the single fusible wire mentioned, the cable and single wire being run parallel to each other.

As fires do not start upon the ceilings of rooms (where the ordinary thermostats are placed), the automatic wires referred to would be run around baseboards, backs of benches, through closets, under staircases, etc.; in fact, so as to cover every danger point where a fire would be likely to start. These danger points can be scientifically located for each class of risk, by reference to insurance tables giving the accumulated experience of all the insurance companies for a period of years, as well as by individual judgment in each case.

It will therefore be seen that such an equipment would provide a number of auxiliary stations, which, when manually operated, would instantly set the street box in motion, thereby giving the alarm to the fire department, and would also provide for the covering of all danger points in the building by an automatic cable, as indicated.

It takes actual flame, or a temperature of 360 degrees without flame, to cause this wire to send in an alarm, and this, therefore, prevents false alarms from an overheating of a building which might not necessarily be dangerous. This failure to act until flame comes in contact with the wire, or until a temperature of 360 degrees is reached, does not imply that the wire will not give the alarm for an actual fire as quickly as a thermostatic equipment would do. On the contrary, it would doubtless in most cases give it quicker, for the reason that every fractional part of an inch of the wiring of an auxiliary system would be an alarm-giving point, located where the fire would probably start, instead of being away up on the ceiling, perhaps many feet away from the fire.

Under the influence of the flame, or 360 degrees of heat, the single fusible wire melts open, and the fusible metal covering of the inner wire in the cable melts and, forcing its way through the insulation, makes a solid soldered connection with the series of copper wires described.

This action of the wire produces a condition in the auxiliary system exactly the same as that brought about by the manual pulling of one of the auxiliary boxes, and the alarm through the street box is the immediate result.

To sum up briefly, the automatic auxiliary system enables the instant and manual sending of an alarm of fire, and also provides that every fractional part of an inch of its wiring shall be an untiring watchman, ready at all times to instantly give the alarm when fire makes its appearance.

General Distribution from Central Stations.

PART III.

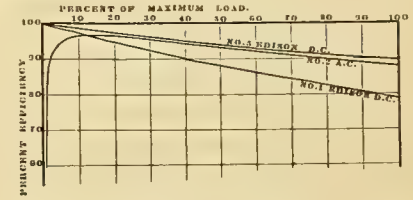
Mr. Thayer: I have been at work for the last three years in remodeling our transformer distribution, and perhaps a short account of what we have done and the results we have obtained may clear up some of this question. When I first took charge of our station there was a large fire which burned out most of the original stock of transformers, type E General Electric, 20 to 40-light sizes. They had an iron loss of 150 to 200 watts each. We began by putting in a few large transformers, in the neighborhood of 100 lights each. After we got started we decided to make our distribution on the lines of the Edison three-wire system. To that end we threw out all the 52-volt lamps and made the 110-volt lamp our standard. We threw out most of the old type of transformers. Four of the transformers got our iron losses down to a little over one ampere. At present we are using 3.1 and 3.3 watt lamps in our downtown district. We have most of our lamps wired on the three-wire system. Our transformers downtown are largely connected into the three-wire network. Wherever the residence lighting is at all heavy near the business districts, we have put in a transformer of from 100 to 150-light capacity, and they run tie-wires downtown. On week days the lighting load is rather lighter than on Sunday nights. It is heavier nights during the week downtown. Sunday nights the conditions are reversed; the churches are on and we have heavier lighting in our residence sections. That equalizes the drop, so that now we have a variation along our mains of about two per cent. In the outlying districts we have been unable to do much with it. In all cases where there are 30 or 40 houses we put in a 50 or 60-light transformer and run at 110 volts. On the house-to-house distribution, wherever it could not be avoided, we put in 112-volt lamps. Our regulation was for four-fifths of our business from 110 to 112 volts, and on the other fifth our voltage would run from 114 to 116. In that way we cut down our iron losses to eight per cent. of the ordinary maximum load. In short, we have simply adopted the Edison system of distribution, modified to meet alternating-current conditions, and we have found there is no question as to the advisability of using large transformers both in cutting down the iron losses and improving the regulation of the plant.

Mr. Chandler: I represent a station which is now running three systems. We inherited a regular low-tension, three-wire system, but we found after a little, as the business increased, that we were running our interest charges up in copper to the extent that there was no profit. We then installed a monocycle machine, although we are running it simply as an alternator, and put in district transformers of 5,000 watts. We take in a section of residence distribution, running the primaries to the large transformers, utilizing the regular three-wire system we have always had in use. We have operated this combination with great success and satisfaction. We tap in on the Edison three-wire system and run a primary 1,000-volt current to the transformer and the regular three-wire system from that. In some cases we have a system so that we can switch from the alternating to the direct current as our needs seem to suggest. Then through the center of the town we still operate the Edison low-tension, three-wire system of 110 volts. It is simply our local conditions that made us experiment with this, but we find it is a complete success. The section that is on the 220-volt-lamp system is as well and economically lighted and gives as good satisfaction as any section that we have. Local conditions may make it advisable to use a 500-volt circuit or the 220-volt lamps, and there is no question but that it can be economically done as far as the wire cost is concerned, and it has been a very satisfactory experiment with us and filled in where the low tension would not. The local conditions perhaps would determine which is the more advisable to use. All three systems may be utilized profitably. I have no doubt that the large transformers are the most economical and elastic.

F. E. Smith: Mr. Wagner referred to the importance of running pressure wires from the centers of distribution to the station. I am about to run pressure wires in my plant, and would be pleased to know more about them.

Mr. Walbank: There is one point in connection with Mr. Wagner's paper I do not agree with. He says the three-phase system is not adaptable to lighting houses. We have installed a three-phase plant of considerable size, and it has been in operation now for six or eight months. Before that we had a single-phase plant supplying between 4,000 and 5,000 lights. The present installation is for 30,000 lights on the three-phase system. We run light and power, and have no difficulty in regulation. We have no regulator on the circuit, as we regulate from the rheostats. We use direct current to take care of elevators in the town. We have about 300 arc lamps. I would like to know why the three-phase system is not adapted to lighting or power.

Mr. Carnes: We use 500-volt arc and single-phase alternating machines. We have not a very large station—about 600 arc lamps, 500 motors of various



GENERAL DISTRIBUTION FROM CENTRAL STATIONS.—COMPARATIVE EFFICIENCY.

sizes, 3,500 alternating lamps, a number of enclosed arc lamps and 25 single-phase alternating shunt motors. I must say that although we are not up in all these modern improvements, we are very well satisfied; we declared a 100 per cent. stock dividend, and I guess nobody wants to turn loose. We are going to wait until you demonstrate fully whether you have anything better.

Mr. Ferguson: There has been a great deal said regarding the efficiency of distribution. Mr. Dow this morning discussed that subject, and I think it is only fair for me to say in the interests of the Edison central stations that are running throughout the country that the figures which I gave in my paper do not fairly represent the average Edison central station, but are really less favorable than might be shown by the average Edison central station, considering the question of efficiency alone. I have therefore had a curve made hurriedly which will show to you the real condition of the Edison central stations of the United States as compared with the curve that Mr. Wagner has presented for his station in St. Louis; and I would state that the general conditions of distribution represented by the curves shown by Mr. Wagner and those shown by the curve I now present to you are the same; in other words, the curve No. 2 in Mr. Wagner's paper represents central stations which are located practically in the business center of the city, and the curve which I now show to you represents the efficiency of distribution of the Edison central stations located at the electrical center. The Edison central stations, such as they have in Detroit and the older stations in Boston and the original Adams street station of the Chicago Edison system and plants of similar nature, have a curve which at all times shows a higher efficiency than that of the best alternating-current station which has been presented. To my mind the question of efficiency in percentages does not mean a great deal, for the reason that we have found it advantageous in Chicago to abandon the central station which gave the high-efficiency curve and build another central station three-fifths of a mile away to take its place. The new system of distribution will not give us as good a curve as the old one; neither will it give as good a curve as Mr. Wagner claims for his central station. But, despite that, the cost of producing a unit of electricity in the new station, with the poor efficiency of distribution, is infinitely less than it was at the central station which gave a higher curve of efficiency. Therefore the real thing is not the

curve of efficiency, but the actual cost of the production of the unit of electricity.

This statement is made in Mr. Wagner's paper: "We can even secure better general regulation than with the direct-current system, as we have a better form of feeder regulation and have eliminated the effects of the transformer drop." It seems to me that is rather a broad statement, in view of the fact that they have no pressure charts to show what the regulation is, and, further, in view of the fact that I have presented to the convention a pressure chart of a direct-current system which shows an average deviation from the mean pressure of less than one volt. It is almost impossible to get a better regulation than that. My chart is taken from a system which employs no feeder regulators; it is self-regulating, with 42 feeders radiating from a center of distribution. There are no feeder regulators and we require none. I would like to see a chart from a central station such as Mr. Wagner describes, and I am sorry he is not able to present such a chart, because I think it would be very instructive. Mr. Rice, I think, inferred from my paper that I thought the alternating machines could not be operated in parallel. We all know that it is being done in certain places. I simply wanted to demonstrate that if the alternating-current companies propose to have pressure regulation equal to the direct-current companies they must operate in parallel; and until that is universally done the alternating-current companies cannot hope to have the same regulation as is found in direct-current systems.

I think the statements that were made by Mr. Wagner in regard to the amount of copper required are somewhat misleading. When you consider the cost of copper in an alternating-current system, such as has been described, together with the transformers for such systems, and the cost of copper in the direct-current system, the difference is slight in comparison with the total investment. I would also point out the fact that the cost of copper, of which such a strong point has been made, is really not so important after all, because the value of the copper is only about 20 per cent. of the underground equipment, and even if you did make a material saving in copper, the total percentage on the total investment would be relatively very small.

The question of motors, I think, I covered pretty thoroughly in my paper, and I think it would be well for us to hear from Mr. Wagner about the amount of power business he is doing with the single-phase system. In regard to the question of alternating-current series arc lamps, it should be understood that these lamps are not used with the system as proposed by Mr. Wagner for commercial lighting, but for street lighting, and I think it would be well for us to hear from Mr. Wagner the reasons why he does not use them for commercial lighting. There is no speculation whatever in the figures which I have given, as they are taken from the actual statistics of the company, and of course we do not know about the figures which have been given on the alternating side, as the system outlined is not fully developed, and has been in use only for a limited time, and it is possible that the figures are more or less speculative. It is a question whether it is fair at the present time to compare the two systems, as one has been in use for a long time and its figures are reliable, and the other has only recently been put into practice, and its figures are in the embryonic state.

Bears Ruin a Telegraph Line.

[From the New York Sun.]

The bears of northern Maine combine a great love for the crab-apples which are grown in that region with ignorance of the appliances of modern civilization. When a telegraph company started to put up poles in the woods between Ashland and Fort Kent, the simple-minded bears began to sniff at the tall sticks with suspicion, evidently mistaking them for some new form of deadfall that was erected for the special purpose of killing bears. They stayed away from the camps of the workmen all the time the route was getting surveyed and while the poles were going up, refusing to respond to the luring odors of scorched fat pork or burnt molasses. But when the glass insulators were screwed to the long arms of the poles, every bear in northern Aristook came out to watch the progress of the work.

Although the superintendent of the job pronounced the line completed and ready for service, the company has been unable to procure the transmission of messages through the long strip of woods above Ashland. A double force of linemen is kept at work all the time, but in spite of their labors, the insulators are pulled off and broken so often that no communication can be kept up for three hours in succession.

The company hired detectives and offered large rewards for the capture of malicious men caught injuring the insulators. As this proved useless, the detectives finally went into the woods and found the whole line swarming with bears that climbed the poles and bit off the insulators faster than the linemen could renew them.

The only way the telegraph men can account for this perverted taste on the part of the bears is that the animals believe that the insulators are their favorite crab-apples, and will not be convinced of their error until they have gone aloft and made actual proof. The telegraph lines will apparently be able to do no business until every bear in Aristook County has thus satisfied itself.

Legal Status of the Street Car Defined in England.

[London Correspondence of the New York Sun.]

In Germany the bicycle, and in England the street car have at least received legal definition. I believe the bicycle is still undefined in English law, but in Germany the existence of a bridge where toll is charged on everything that passes over it demanded that the question should be settled at once. And now the impost is paid for the German 'cycle under the description of "small cattle, with driver or attendant." This result seems to have been arrived at easily. But to settle what a tram car really is has been a long and expensive matter in England. Here, too, it was a question of paying bridge toll. By an act of Parliament, passed in the seventh year of George III., for "Every coach, chariot, Berlin chaise, chair or calash, drawn by more than two horses, the sum of sixpence" had to be paid to cross the Stonehouse bridge, in the county of Devon, while, "For every wagon, wain, dray, car, cart, or sledge, or other carriage, drawn by three or four horses or oxen," only fourpence had to be paid.

Now, under which heading did a street car come? The company denied that a street car was a coach, chariot, etc., and that though it was not a wagon, wain, dray, or any other vehicle mentioned in the second list, it certainly came under the heading of "other carriage," and so need only pay fourpence.

"Coach" or "other carriage?" was the question asked through all the inferior courts. And at last it came before the lord chancellor and the House of Lords. With a display of deep erudition the Lords settled that a street car was a coach. The lord chancellor argued thus: He admitted that the legislators of George III.'s day had not contemplated such a thing as a tram. Still, he thought "coach" was the only word in the lists which could include "tramcar."

"I think," said he, "that in the period when this statute was passed, and, indeed, long before it, the word 'coach' was a general word applicable to various kind of vehicles varying both in shape and capacity of carriage. So Shakespeare says:

> Thou shin'st in every tear that I do weep;
> No drop but as a coach doth carry thee.

"And also:

> But come, I'll tell thee all my whole device
> When I am in my coach, which stays for us
> At the park gate.

"And in Carey's play, 'Chrononhotonthologos,' published not many years before the date in question —namely, in 1734—occurs this passage:

> Go call a coach, and let a coach be called,
> And let the man who calleth it be the caller;
> And in his calling let him nothing call,
> But Coach! Coach! Coach! O for a coach, ye gods!

"The use of the words 'coach-house,' 'coachman,' and 'coachbuilder,' which, of course, are not appropriated to any particular classes of vehicle, leads to the same conclusion that 'coach' is a general name, which certainly would comprehend a tramcar, and therefore make it primarily the subject of some toll. But the question still remains, What is the particular toll, where the Legislature has divided into different classes both the tolls and the vehicles? I cannot say that I can regard with complete confidence the conclusion at which I have arrived; but I think that, for the reasons I have given, a tramcar is a coach. I think a category which begins with 'coach' and apparently excludes the heavier vehicles appropriated to the carrying of goods rather than passengers, is the one in which I must include the tramcar. I think that a category which begins with 'wagon' and ends with 'sledge,' the intermediate words being 'wain,' 'dray,' 'car,' 'cart,' does appear to suggest the carriage of goods, and not of passengers, as being the genus of vehicle to which that particular toll is applicable."

So his lordship voted for coach, and their other lordships agreed, though they admitted that "the case was not free from difficulty."

Dr. Hopkinson Killed in the Alps.

A news dispatch from Berne, Switzerland, dated August 29th, conveys the shocking intelligence that Dr. John Hopkinson, his son and two daughters were killed while ascending a mountain in the Canton of Valais, where the mountains are among the highest in Europe, and on which destructive avalanches are of frequent occurrence. The party had gone on their perilous trip without the assistance of guides. Dr. Hopkinson had intended starting for New York on September 28th, the trip to be made in connection with a syndicate which he was forming for the purpose of developing his inventions.

Dr. Hopkinson was probably fairly entitled to the distinction of being the leading electrical engineer of Great Britain, and he was one of the foremost men of his profession in the world. He was a native of Manchester and 49 years of age. He graduated from Trinity College, Cambridge, in 1871 a senior wrangler, and engaged in engineering work in Birmingham the next year. He removed to London in 1878 and began general practice as an engineer. He became known as an expert in patent causes and engaged in scientific research. He was best known for his work in dynamo design. In 1883 he made improvements on the existing type of Edison machine, and in England his name is associated with that of Edison for incandescent-lighting dynamos. Dr. Hopkinson developed the theory of alternating currents and made elaborate experiments on the magnetic properties of iron and steel. He also designed several of the largest electric-lighting plants in Great Britain. He was a fellow of the Royal Society, twice president of the Institution of Electrical Engineers and a member of several other engineering and scientific bodies.

CORRESPONDENCE.

New York Notes.

New York, August 29.—The Yankee, one of the auxiliary cruisers manned largely by the Naval Militia, including several electrical men, returned to New York yesterday after a six weeks' cruise. Lieutenant S. Dana Greene is an officer on this ship, which took an honorable part in the naval operations in the West Indies. No shore leave was granted yesterday, and, although the immediate future of the Yankee has not been announced, the naval reserves aboard her are confident that they will soon be mustered out of the service. It is said that they are not sorry to relinquish their duties on board ship, now that the war is over.

Answering a bear attack on the stock of the Brooklyn Rapid Transit company, Flower & Co. made this statement: "The story contains nothing of vital importance against the company and suggests nothing new. It is grossly unfair, because it shows everything in its worst light, while it purposely leaves out some of the strongest items that are favorable to the company. It does not mention the $4,000,000 deposited as a guarantee fund for dividends and for the lease of the Brooklyn City railroad lines. Every cent of the interest on this fund goes to the Brooklyn Rapid Transit company, and amounts to about $200,000 a year. It apears in the reports under the head of 'other income.' Then, again, the new construction account of between $3,000,000 and $4,000,000 is not even referred to. Three-quarters of the interest on this sum is paid to the Rapid Transit company by the Brooklyn Heights company, the latter company charging this payment up to operating expenses, and thus reducing its net earnings by that amount. The interest from these two sources, so carefully suppressed by the originators of the bear attack, will about pay all the fixed charges of the Rapid Transit company. In the last report of the company the cash on hand is placed at $400,000, and the company had no floating debt."

Judge Lacombe of the United States Circuit Court for the Southern District of New York has issued preliminary injunctions on the Condict patent, controlled by the General Electric company, against the Nassau Electric Railroad company of Brooklyn, enjoining the further use of the electric-car controllers which were made by the Steel Motor company, and against the Walker company, enjoining its manufacture of the several types of series parallel car controllers made by it. The operation of this injunction is suspended until the next session of the Court of Appeals, to give the defendants an opportunity for appeal. This is the patent recently sustained at final hearing by Judge Townsend in a suit against a user of Walker controllers.

Bids for building a new range-finder tower and instrument room at Fort Hancock, Sandy Hook, were opened on Thursday. Five bids were submitted, as follows: S. P. Althouse & Co., $3,995; New Jersey Foundry and Machine company, $7,000; Post & McCord, $3,700; Bethlehem Foundry and Machine company, $2,787; Greeley, Wythe & Co., $3,875. The bids were forwarded to Washington, where the contract will be awarded. The tower is to be built of iron and steel on a concrete foundation, from which and inside the tower an iron stairway leads to the instrument room.

On the day of the great naval parade of the returned battleships on the Hudson Thomas A. Edison closed his laboratories and factories in Orange and vicinity to give all his workmen "a chance to cheer for Sampson."

Section 65 of chapter 566 of New York laws of 1890 makes it the duty of any electric-light corporation, under penalty of certain forfeitures for failure therein, to supply the electric light required for lighting any building or premises within 100 feet of a main, upon the application, in writing, of the owner or occupant, etc. But in the recent case of Andrews against the North River Electric Light and Power company, the General Term of the City Court of New York holds that a written notice was insufficient which read: "In compliance with the statutory provision, I hereby demand that you supply me at my office, 729 Tremont avenue, New York city, with electric light and power at once." On the same day that the notice was served, the company replied: "How many lights and how much power do you want?" which inquiry was never answered. Under the circumstances, as it views the law, the court holds that there was a failure to establish a cause of action against the company because of the failure to specify in writing the number of lights and how much power was required.

M. S.

Northwestern Notations.

Minneapolis, August 29.—The interurban electric line connecting Neenah and Menasha and Appleton and Kaukauna with Lake Winnebago, Wis., is carrying large crowds to the lake every night, and the traffic is all that the promoters expected.

Mr. Lindsay of Manvel is negotiating with Turtle River, N. D., on the matter of putting in an electric-light plant.

Perham, Minn., voted to establish an electric-light and water system.

J. H. Powers has the contract to erect a power station for the electric-light plant which General Hughes of Bismarck, N. D., will establish.

W. I. Gray & Co. of Minneapolis were awarded the contract to install the electric-light and water plant for New Paynesville, Minn., for $8,306.

Wolf Egersdorfer sues the Mankato (Minn.) Gas and Electric Light company for $3,000 damages, rereceived from coming in contact with a broken guy wire charged with electricity. He says his head and parts of the body were seriously burned and permanently scarred, and that his nervous system suffered.

Two Harbors, Minn., has voted $8,000 bonds for an electric-light plant.

Marcus Johnson has offered to furnish electric street lighting for Red Lake Falls, Minn., for about $500 per annum.

The street-railway company of Butte, Mont., will extend a line to the Columbia Gardens and give service to that point if a park is established and maintained there. Funds are being raised to purchase the gardens for a park.

Over 350 electric lights have been contracted for on the plant now being installed for Neola, Ia.

The council of Tacoma, Wash., has passed a resolution granting a franchise to William T. Baker of Chicago for an electric-light plant, but limiting him to the city of Tacoma as the sole purchaser of light and power.

The Postal Telegraph company has filed articles of incorporation in Iowa, with $50,000 capital stock.

W. J. Bonwell of St. Paul will furnish an estimate of cost for an electric-light plant for Winnebago City, Minn.

People of Jackson County, Wis., are urging that the projected electric car line from Melrose, Wis., to La Crosse be constructed.

It is understood local capitalists of Glencoe, Minn., are about to form a company and establish an electric-light plant.

C. N. Kalk and T. B. Gibson of Milwaukee are taking preliminary steps for the construction of the new electric-car line between Kilbourn and Devil's Lake, 20 miles. C.

Canadian Intelligence.

Ottawa, August 27.—The town of Dundas, Ont., will give a franchise for 15 years to an electric-lighting company of which George H. Harper is managing director, the town to have 150 incandescent lamps and four arc lights. The lights will cost the town $1,100 per annum.

The plan proposed for an electric railway between the towns of Lanark and Perth, Ont., is being revived. The subscribed capital is now said to be sufficient to build the road, and the company undertakes to complete it by the 1st of April next.

The West Kootenay Power and Light company is now delivering 1,000 horse power in Rossland, B. C., from its generators at Bonnington Falls, 30 miles away.

It has been decided not to extend the electric system of railway from Quebec to Montmorency this year, but everything will be got in readiness during the winter to change the motive power of the entire railway from Quebec to Cape Tourment from steam to electricity next spring.

A number of Montreal gentlemen have purchased a mountain at St. Bruno, in the Chambly district, about 10 miles from Montreal, and propose spending a large sum in improvements. An electric railway from Montreal to St. Bruno is included in the plan.

Another heavy transaction in electric property is on foot in the province of Quebec. Following the absorption of the Quebec District Railway company by the Quebec, Montmorency and Charlevoix company, the latter is about to acquire the property of the Montmorency Power company, which furnishes the city with electric light and the street-railway cars with their motive power. It is understood that the purchase price is $1,250,000. A meeting of the Quebec, Montmorency and Charlevoix Electric Railway company will be held on the 13th September next to ratify the purchase. The shareholders of the power company will receive a handsome premium on their stock, which will be 25 per cent. of its value in cash, while they will also raise in the stock of the Quebec, Montmorency and Charlevoix railway an amount equal to their stock in the Montmorency Power company.

Mr. Henry Symons, Q. C., has recently returned from England, where he had estimates prepared for the construction of the proposed works of the Welland Power and Supply Canal company. This project involves the construction of a canal from the Welland River to the brow of the mountain at Thorold, Ont., a distance of eight miles; the construction at Thorold of a power house, and from Thorold to Lake Ontario a raceway by which to carry water into the lake. In addition to these different works, estimates were obtained for the construction of a transmission line from Thorold to Toronto, by way of Burlington Beach. The estimate for the machinery to generate 100,000 horse power is £125,000; for transmission line to Toronto at a voltage of 10,000 and delivery of 50,000 horse power, £801,600; for excavation and other work connected with the undertaking, £1,525,062. The total estimate therefore amounts to £2,452,162, or, roughly speaking, $12,000,000. If the amount to be delivered in Toronto is reduced to 20,000 horse power, the project would cost $1,000,000 less. S. Pearson & Son, contractors, state that if the contract could be secured from the cities of Toronto and Hamilton for a considerable quantity of power, for a definite term, there would be little difficulty in raising money for the project by bonds and shares in Great Britain. W.

PERSONAL.

E. C. Bickel, secretary and general manager of the Elkhart Telephone company of Elkhart, Ind., was a recent Chicago visitor.

Mr. T. Wilkinson of Brockville, Ont., manager of the Brockville Light and Power company, is spending a few days in Chicago. Mr. Wilkinson has been enjoying a pleasure trip through Wisconsin.

President Joseph Franklin of the Commercial Electrical Supply company of St. Louis visited Chicago last week. Mr. Franklin was on a combined business and pleasure trip, having spent a few days in Lake Beulah, accompanied by Mrs. Franklin.

Mr. F. E. Drake of the Walker company has been selected as electrical adviser to Ferdinand Peck, commissioner-general of the United States to the Paris Exposition of 1900. Mr. Drake sailed for France with the commissioner-general and party on the steamer La Touraine from New York on September 3d. He expects to return to this country about the middle of October, and will then resume his duties with the Walker company.

At the Boston meeting of the Society for the Promotion of Engineering Education the following-named officers were elected: President, T. C. Mendenhall, Worcester Polytechnic Institute; vice-presidents, C. F. Allen, Massachusetts Institute of Technology, and H. W. Spangler, University of Pennsylvania; secretary, Albert Kingsbury, New Hampshire College of Agriculture and Mechanic Arts; treasurer, J. J. Flather, University of Minnesota. The following-named gentlemen were elected members of the council to serve for three years: T. M. Dunn, M. A. Howe, I. N. Hollis, G. Lanza, P. C. Ricketts, R. G. Thomas and C. M. Woodward.

Major Samuel Reber, U. S. A., of the Signal Service, has done good service in Porto Rico, as many electrical friends will rejoice to know. His men established telegraphic communication between the different commands very speedily after landing, although the enemy had naturally made the task as difficult as possible by cutting existing lines and destroying batteries and instruments. This was anticipated, but the electrical supplies from the United States seemed to have gone astray, and Major Reber had to procure or devise apparatus as best he could. In 17 days, in an enemy's country, the Signal Corps established or repaired 170 miles of telegraph or telephone lines in five circuits.

Sophia Braeunlich, the business manager of the Engineering and Mining Journal, died on August 11th. Mrs. Braeunlich was but 45 years of age, but she had had a very successful business career. She entered the office of the journal to which she devoted her talents in 1879 as an amanuensis, and rose, step by step, until she was appointed business manager in 1890. Her supervision covered the entire force and business of the company and its offices in many parts of the world. "Nothing was neglected," says an associate, "nothing escaped her wonderful penetration; everything was organized with admirable system, and conducted with energy, enterprise, sagacity and with the very highest standards of honor and honesty." Mrs. Braeunlich was the first American woman elected a fellow of the Imperial Institute of London.

ELECTRIC LIGHTING.

The city of Arlington, Ga., will hold an election to determine the issuance of bonds for the erection of an electric-light plant and the construction of a system of waterworks.

Sealed proposals will be received by the city auditor of Portland, Ore., up to 1 p. m., September 19th, for lighting the streets of Portland with arc and incandescent lamps for two years, commencing April 1, 1899, in accordance with plans and specifications on file in the auditor's office, copies of which will be furnished on application. A certified check for $30,000 must accompany each bid. A bond of $100,000 will be required of the successful bidder. J. C. Luckel, W. A. Storey, H. A. Belding, G. L. Baker and J. D. Meyer are the committee on street lighting.

ELECTRIC RAILWAYS.

The statement that the Illinois Central line between East St. Louis and Belleville, Ill., is to be equipped for electrical operation by the third-rail system, which was made in an eastern paper, is officially denied.

The Indiana Railway company, which contemplates building an electric railroad between Benton Harbor, Mich., and South Bend, has secured right-of-way in Berrien County, Mich., to Niles, about 25 miles. J. A. Russell, J. S. Hardell and William Vancleave of Detroit, Mich., are promoting the enterprise.

It is reported that Horace B. Turner and E. M. Hopkins, both of Chicago, are interested in the project to build an electric railroad from Grand Rapids to Muskegon. The distance is about 30 miles. Mr. Hopkins is president of the Rock River Electric Railway company, now building a road from Rockville, Ill., to Oregon, Ill.

Now that the Hawaiian Islands are a part of the United States, news of electrical progress there becomes particularly interesting. That matters electrical are moving forward to some extent is shown by the Honolulu Commercial Advertiser of August 16th, which notes that August Drieir, manager of Eleeh plantation, has given an order to Theodore Hoffman, manager of the Hawaiian Electric company, for the equipment of two miles of electric railroad. This order includes an electric locomotive.

Sanderson & Porter, contractors for the Meriden and Compounce Electric Railroad company, have let the contract for furnishing several bridges and buildings on the line of this road to the Berlin Iron Bridge company of East Berlin, Conn. The work consists of seven spans of bridges, varying in length from 10 feet to 65 feet, a car barn 50 feet wide and 100 feet long and a power house 45 feet wide and 75 feet long. The bridges are of steel, and the buildings have steel framework, brick side walls and fireproof roofs. The roof of the power house is covered with corrugated iron and lined with the Berlin Iron Bridge company's patent anti-condensation roof lining.

ELECTRICAL SECURITIES.

The second quarterly report for the Troy City Railroad company shows net earnings of $67,429 on gross earnings of $132,743. The fixed charges amount to $35,997. The company of late has enjoyed a prosperous business.

The favorable reception accorded to the bonds of the Commonwealth Electric company of Chicago is gratifying to the management of the Chicago Edison company, as it is recognized as an indication of public confidence in the latter corporation, which is so closely affiliated with the new concern. Another source of gratification to the same interests is the fact that Chicago Edison stock was sold at 150 last week, the highest point attained since 1893. This is the first time the stock has reached this figure since the new capitalization. This evidence of confidence felt by investors is appreciated by President Insull and the directors of the Chicago Edison and Commonwealth Electric companies.

MISCELLANEOUS.

A Los Angeles man has designed an electrically propelled patrol wagon and ambulance. It is fitted with rubber tires and has a two horse power motor, a small searchlight and two side-lights.

C. B. Roos is agitating the subject of putting in three plants at San Bernardino, Cal.—one for furnishing gas for both lighting and heating purposes, a plant supplying electricity both for lights and mechanical purposes and a plant to furnish power for an electric road to run from the depot to Base Line.

The Navy Department is inviting sealed proposals until September 13th for furnishing the Norfolk, Va., navy yard with two direct-connected electric generating sets, one switchboard and 30 lightning arresters. Prospective bidders desiring specifications and blank forms of proposals can obtain them upon application to the navy pay office at Norfolk, or to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

After 120 years of daily service what is said to be the oldest working engine in the world was recently released from all labor and will now simply do duty as a relic. In 1775 James Watt, in partnership with Boulton, in Birmingham, England, began the manufacture of steam engines. Two years later they built an engine for the Birmingham Canal Navigation company. The engine had a 32-inch cylinder and an eight-foot stroke, large dimensions when compared with modern engines. But a low pressure of steam was used, for which reason the great power produced by modern high-pressure engines could not be realized. The James Watt company will now furnish the canal company with two triple-expansion vertical engines with a capacity of pumping daily 12,713,000 gallons of water, while the old engine will rest.

TRADE NEWS.

The Machinery and Electrical company of Los Angeles has been recently reorganized. Mr. Nolan has retired and Mr. H. T. Duff is now sole owner and proprietor.

The arc-lamp bulletin of the Western Electric company, numbered 7002, contains full data of the company's open and enclosed arc lamps of all varieties. It also gives information of switches, globes,

theatrical lamps, focusing lamps, etc., and is valuable for reference.

The Willard Third Rail company, 27 William street, New York, has secured the contract for laying rail on the Long Island railroad, and will commence operations about the middle of September.

The Electrical Supply company of Sioux City has doubled its capital. Mr. E. C. Spalding has been elected treasurer and purchasing agent. Mr. H. O. Woodruff has taken a position on the road. This company has had a good business, and now, with ample capital, is going to push both jobbing and construction work.

The Western Electrical Supply company of St. Louis reports the sale in the last week of a large number of Adams-Bagnall arc lamps, for which it is sole western agent, among which was an order for nearly 100 for the Crawford Dry Goods company of St. Louis. The same company also sold during the week 200 kilowatts capacity of Eddy dynamos, for which it is the sole western agent.

A late addition to the beautiful Westinghouse catalogues is one entitled 'Quarter of a Million Horse Power of Polyphase Electric Transmission Apparatus." The little book is illustrated with very finely executed halftones representing notable polyphase plants and machines, and it has a list of Westinghouse two and three-phase installations. The cover of the pamphlet bears a striking design in colors.

The General Electric company will be well represented at the Boston street-railway convention by engineers and agents, and will have an exhibit at Mechanics' Hall both interesting and novel. It will establish its headquarters at the Brunswick Hotel, with a reception room on the first floor, whither all delegates are invited and will be made warmly welcome. Advantage will be taken of the fact that Boston is distinctly a General Electric center to arrange a series of visits to different stations where General Electric apparatus may be seen in commercial operation and to illustrate the history of rapid transit and the actual development of the electric railway. The proximity of the Lynn works of the company will also afford the delegates an opportunity of visiting them and of appreciating the excellence of the methods employed in the construction of railway apparatus. Much new literature will be published by the General Electric press for distribution at the convention and will be found by delegates at Mechanics' Hall and at the company's headquarters. To Mr. W. J. Clark, general manager of the railway department, the interests of the General Electric company will be confided. He will be assisted by the following-named representatives: C. C. Pierce, F. M. Kimball, Percy Hodges and C. D. Haskins, Boston; W. D. Fish, Lynn, Mass.; W. B. Potter, F. E. Case, H. C. Wirt and W. G. Carey, Schenectady, N. Y.; R. B. Beach and J. J. Mahoney, New York; W. G. Bushnell, New Haven, Conn.; H. J. Crowley, Philadelphia; A. F. Babson, Baltimore; Theo. P. Bailey, Chicago; George D. Rosenthal, St. Louis; F. H. Strieby, Cincinnati; F. F. Barbour, San Francisco; S. W. Trawick, Atlanta, Ga.

BUSINESS.

The Illinois Electric company, Chicago, is now in a position to furnish an incandescent arc lamp for direct or alternating current. It guarantees these lamps in every respect and asks the trade to secure its prices before placing orders elsewhere.

The Western Electric company's station instruments are the subject of Bulletin 5 I N issued by that company. Characteristics, pictures and prices are given for the arc ammeter, current-direction indicator, voltmeter and general ammeter made by the company.

The water-wheels supplied by the American Impulse Wheel company of 120 Liberty street, New York, are described in a recent catalogue, which is sent on application. Impulse wheels, turbines, water-wheel governors and water motors are illustrated and the prices given.

The Standard Telephone and Electric company of Madison, Wis., reports flattering sales for its new Standard dry battery, for telephone work, which is said to be without an equal. John W. Brooks, Monadnock block, Chicago, is pushing the new Standard dry battery for telephone and electro-medical work.

Vice-President W. N. Matthews of the St. Louis Electrical Supply company reports a most excellent business. This company has recently gotten out a fine fixture catalogue showing the great variety of designs of that specialty now being pushed by the St. Louis Electrical Supply company. It is a most complete volume, and the handsome cuts in it, as is not often the case, show the merits of the fixtures in an admirable manner.

While iron and steel-armored conduit is being used to the exclusion of almost everything else in new conduit work, there is nevertheless a great deal of work where iron-armored conduit cannot be used. The most satisfactory substitute under such circumstances is said to be Canvasite flexible conduit. This is particularly useful in wiring or rewiring old buildings and in difficult and out-of-the-way places in new buildings. The Electric Appliance company is carrying Canvasite flexible conduit in all sizes from ¼ inch to 1¼ inches and finds that it has a ready sale for the above-mentioned uses.

Martin J. Insull, manufacturers' agent, has just returned to Chicago from a two weeks' trip to New York and other eastern cities. Mr. Insull only recently established his office in Chicago as manufacturers' agent, but previous to that time he had for several years been in exclusive charge of the manufacturers' agency portion of Sargent & Lundy's business, Chicago, Mr. Insull being at that time a member of that firm. During his trip East Mr. Insull renewed his arrangements with the C. & C. Electric company and also with the Fort Wayne Incandescent Lamp company. He also established further connections with the manufacturers of the D. & W. fuses and other specialties. He consummated, too, a deal with the Electrical Appliance company of New York to handle its Novel gravity motor controller, a device which has attracted considerable attention in the East. In addition Mr. Insull desires it known that he will handle Bergmann switches and other supplies manufactured by the General Incandescent Arc Light company, acting as sole agent in the middle West, with the exception of Cook county. Mr. Insull has pending arrangements with several other manufacturers, which are likely to be consummated in the near future.

The Western Electrical Supply company of St. Louis notes very flattering returns from its mammoth general catalogue No. 14 A. This is very gratifying to the company, considering the labor and expense involved in the publication of a book of this magnitude. The company will have ready for distribution within the next week a very neat and complete electric-railway catalogue, No. 16 A. It is stated that this book will be one of the most complete electric-railway catalogues issued, covering fully a complete line of electric-railway supplies, a branch of the Western Electrical Supply company's business that is being pushed energetically.

Some trade catalogues are bright and interesting; some are dull and tedious. To the former class belongs the new booklet of the Mica Insulator company of New York, and as it is sent for the asking, electrical men will find it worthy of an application. The work is full of information for the electrical engineer, manufacturer and street-railway man. The illustrated account of mica mining in India is very interesting and makes a capital introduction to the catalogue. The primitive state of affairs there, practically the same as a thousand years ago, forms a striking contrast with the advanced state of the art of producing micanite. There are few matters pertaining to electricity in which this country has not had a controlling influence. Micanite is truly American. The name and the material, although only five years old, are known in every country that can boast of an electric dynamo or motor. The tables, giving data of all kinds for some twenty-five different insulating materials, are valuable and will be appreciated. There is an article upon the construction of commutators which includes tables of various data and sketches of the latest designs. Micanite plate, flexible micanite plate, micanite cloth and paper, red paper and mica insulations, micanite rings, troughs, washers, tubes, spools, cylinders, etc., are described and illustrated. Complete insulations for 51 different types of street-railway motor commutators are kept in stock. The number of types will give an idea of the extent of the electric-railway business. This part of the catalogue will be appreciated by the street-railway companies and repair shops in facilitating quick repairs. The other materials manufactured by the company include Empire oiled cloths, oiled papers, oiled linen, oiled asbestos, etc., and similar materials treated with M I C compound. The catalogue is well arranged and will no doubt enhance the Mica Insulator company's already extensive business.

ILLUSTRATED ELECTRICAL PATENT RECORD.

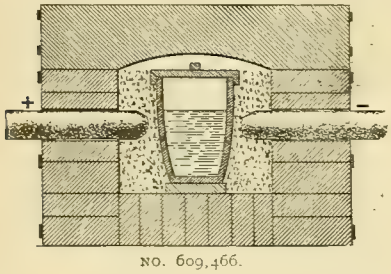
Issued August 23, 1898

609,421. Device for Attaching or Detaching Electric-lamp Bulbs. Charles G. Edwards, Albert Lea, Minn. Application filed Januray 24, 1898.

A device for attaching and detaching the bulbs of electric lamps consists of a rotatable handle, a suitable grasp or holder for engaging with the bulb and connecting with the handle, and a suitable guard extending out from the handle.

609,466. Alloy of Iron and Titanium and Process of Producing It. Auguste J. Rossi, New York, N. Y. Application filed June 5, 1895.

The process of producing a new compound or alloy of titanium and iron, containing some carbon, and titanium in industrially important proportions, that is to say in excess of five per cent. of titanium, consists in supporting in a bath of molten iron and while subjected to intense heat, say not less than 3,500 degrees Fahrenheit, a mixture of carbon and of titanic acid.



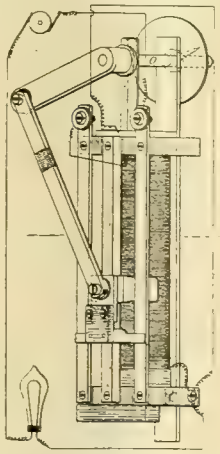
NO. 609,466.

609,639. Electro-medical Apparatus. Reinhold H. Wappler, New York, N. Y. Application filed November 2, 1897.

The combination is claimed with the rheostat coil, the slider and contact and a crank and connecting rod for moving the slider, of a dial and hand by which to indicate the action of the rheostat in the electric circuit, there being insulating material upon which the sliding contacts rest when the current is turned off.

609,640. Burglar Alarm. Daniel L. Wartzenluft, Kutztown, Pa. Application filed November 16, 1897.

A burglar alarm comprising an electric circuit, the wires of which are extended across a window or the like, an alarm in the circuit, and a circuit closer mounted to swing on one of the wires and adapted to close the circuit when swung out of its normal engagement with the window or the like.



NO. 609,639.

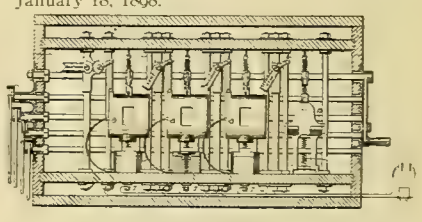
609,643. Machine for Shaving Electrotypes, Stereotypes, etc. Ferdinand Wesel, New York, N. Y. Application filed November 5, 1897.

In a stereotype-shaving machine there is the combination, with the support of a knife head guided on the same, pivoted gauges on the support, the gauges being provided with lugs of different sizes, a knife supported on the face of the knife head, stop lugs at the ends of the knife head, and means for raising or lowering the knife head until the same is arrested by contact with the stop lugs of the gauges.

609,702. Manufacture of Fluid for Impregnating Fibers for Incandescent Lighting. Gerhard B. Puchmüller, Schöneberg, Germany. Application filed March 21, 1898.

The method described of manufacturing a fluid for impregnating fibers, fabrics or bodies to be used for incandescent lighting consists in combining oxides of strontium, zirconium, barium and aluminum and dissolving the same.

609,732. Apparatus for Signaling on Locomotives. Frank A. Cheetham, Rastrick, and Ralph Bostock, Brighouse, Enfigland. Application filed January 18, 1898.



NO. 609,732.

In an apparatus for signaling in locomotives there is the combination with a weighted faller and a semaphore connected thereto, carried by the locomotive, of means for supporting the faller, a shaft and connections for releasing the faller, a pivoted lever carried by the locomotive, connections between the lever and the shaft for operating the latter, a plate situated between the tracks, and means for operating same to bring it into contact with the pivoted lever during the travel of the locomotive, so that through the shaft the faller is released and the semaphore operated; and means for raising the faller.

609,745. Diaphragm for Electrolytic Purposes. William G. Luxton, Liverpool, England. Application filed April 9, 1898.

A diaphragm is made of a composition of cement, sand and a porous material mixed with water and allowed to dry, or set, the diaphragm having pores through the substance of the porous material and interstices between the cement and the other constituent particles.

Western Electrician.
EVERY SATURDAY.
Vol. XXIII. CHICAGO, SEPTEMBER 10, 1898. No. 11

Modern Central-station System at the Trans-Mississippi and International Exposition.

As an educational feature the exhibit of the Chicago Edison company at the Trans-Mississippi and International Exposition at Omaha is one of the most attractive and instructive collections in the Machinery and Electricity building. It is scarcely necessary to say that this exhibitor is essentially a central-station company, engaged in supplying electricity for light, heat and power in the city of Chicago, and, consequently, that its only aim in appearing on the scene at Omaha is to illustrate the development of the central-station business along the lines it has followed.

The management of the exposition could not have made a better selection than the Chicago company as a representative of the highest development of the modern central-station system of American cities. In every respect it deserves to be ranked as one of the greatest corporations of its kind in the world. Its development has been particularly noticeable because of the liberal policy of the management in introducing improvements and working out for itself in some instances new ideas that have been considered a radical departure from the old theory of low-tension service. In the exhibit at Omaha it has been the aim of the company to show the organization and development of the business from its inception in such a way that anyone familiar with central-station work can understand and appreciate the significance of every feature illustrated.

The exhibit is arranged in a very attractive booth which occupies a favorable position at the head of the main aisle and close to the principal entrance to the electricity department. In design it adheres closely to the Greek type and is constructed of staff finished in pure white. Corinthian columns add greatly to the imposing appearance of the booth, as may readily be seen by glancing at the exterior view on this page (Fig. 1). Above the entrance appears the name "Chicago Edison Company," and this is sufficient to attract the attention of visitors who are at all familiar with electrical matters.

Fig. 1. Chicago Edison Company's Booth.

A general view of the interior of the booth is also presented on this page, in Fig. 2. No attempt is made to advertise anybody's wares and there is an evident purpose to avoid everything pertaining to the commercial aspect of the businesss. It is purely an educational exhibit and as such occupies an unique position in the exposition. On the walls are arranged photographs illustrating the most important construction features of the company's plant, diagrams and tracings presenting detailed information of similar character, load diagrams and pressure charts, blank forms of contracts, orders and reports of the several departments and photographs and a diagrammatic sketch illustrating the system of organization of the operating force and the heads of divisions in their order. One wall is given up to photographs of the company's stations and the service plants it has installed, and another is devoted to an illustration of the underground system of distribution, the apparatus employed and the relations of each part to the general arrangement. The east and north walls are covered with four immense frames and several racks with movable frames, containing photographs and blanks, diagrams, blue-prints, records, tickets and slips illustrating many features of the system. In the views of the stations are included the original structure on Adams street and subsequent additions showing the development during the construction period from the time the foundations were completed until the time the machines were turning over, as well as the equipment and general arrangement of the several power plants and cross-sections and plans of the principal stations. This is particularly true of the Harrison street station, of which a complete photographic record is presented, including every piece of machinery and every feature of construction in that interesting plant. The

Fig. 2. Interior View of Chicago Edison Company's Exhibit.

MODERN CENTRAL-STATION SYSTEM AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.

operating department furnishes interesting and characteristic curves of the load at different times during the year, both for high and low tension. In this connection the composite ampere curve of the low-tension system which was published in the Western Electrician June 4, 1898, is interesting as showing the growth of the business and also showing that the load has maintained the same general characteristics year after year from the time when the volume of business has been sufficiently large to show any particular characteristics.

The pressure charts are also interesting to the central-station operator, and the feeder reports likewise show the result of the care and forethought of the modern central-station general superintendent in laying out a system of feeders so that the load is equalized and an even pressure maintained throughout the network. These feeder and pressure charts show what may be accomplished through the Edison interconnected network when properly laid out.

It will be noticed that a conspicuous feature of the exhibit is the arrangement of the underground system, illustrating by actual material fastened to wall the method of running the feeders and mains, series arc circuits, etc., and particularly the use of the Tailleur junction box and the Tailleur high-tension joint, both of which the company uses extensively in Chicago. These devices are familiar to the readers of the Western Electrician. The exhibit also shows the arrangement of house wiring from the service through the cutout and service switch and the connections to the wattmeter and Wright demand meters and thence to the house circuits.

One of the largest departments of the company is that devoted to wiring for electric service residences, offices, factories and stores. To illustrate this particular department the company shows a cross-section of the Silversmiths' building, Chicago, with the electrical apparatus for running the house pumps, ejectors, ventilating system, elevators, etc., and illustrating also the method of running the mains and tap lines.

Investors in electric-lighting properties will be interested in the system of accounting which has been developed for the Chicago Edison company and which is known in Edison circles as the "gospel according to St. Anthony," after the comptroller of the corporation. In the collection of forms and contracts presented every piece of stationery is exhibited, from the common dray ticket received by the teamster for a load of cinders or an order for supplies, to the artistically engraved yellow slip on which the president signs his own name for his year's salary. This feature is considered of special value, as the system employed is probably the most complete and comprehensive in use in any central-station company of the country.

Another feature of the exhibition which attracts considerable attention is the panel containing portraits of the officers of the company and the employes directly under their supervision. Fig. 3 is a reproduction of this collection and includes everybody employed in the management and operation of the system, from the president to the messenger boy. In another frame is also shown a diagrammatic representation of the organization, graphically illustrating the relations of the several departments, and the channels through which they report to the president. This is reproduced in Fig. 4 and will furnish material for study and reflection by central-station managers who have not established such a thorough and systematic organization. It is largely to the efficiency of the organization of the Chicago Edison company, the ability and faithful service of the gentlemen in charge of of the several departments and the care and watchfulness which this method enables President Insull and his assistants to exercise over the working forces, that the phenomenal success of the corporation can be attributed.

FIG. 3. MODERN CENTRAL-STATION SYSTEM AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION,—OFFICERS AND EMPLOYEES OF CHICAGO EDISON COMPANY.

Association of Edison Illuminating Companies.

The nineteenth meeting of the Association of Edison Illuminating Companies will be held at Sault Ste. Marie on September 12th, 13th and 14th. This will be the fourteenth annual convention of this important body and the outlook is promising for an interesting gathering. In addition to the invitation of the association the local Edison company has issued an urgent request to the members of the organization to send large representations to the meeting. It is anticipated that the response will be quite general, and that nearly all of the 70 companies operating Edison stations will participate in the proceedings. Representatives of Edison interests from the far West and down East—Spokane to New Bedford—will meet at the Soo to exchange greetings and compare notes. The Chicago Edison company, it is needless to say, will be well represented. President Insull will be accompanied by Messrs. Ferguson, Anthony, King, Credon, Gilchrist and Oliver J. Bushnell. It is expected that M. A. Beale of Rockford, Ill., and Herbert A. Wagner of St. Louis will be members of the party. It has been arranged to make the trip by boat over the Great Northern Steamship company's line, as an unusually large eastern delegation is assured. The programme provided for the eastern members assembling at Buffalo on September 9th and embarking there, while members living west of Buffalo assembled at Detroit to join the party at that point on Saturday, September 10th. The delegates will spend a few hours at Mackinac on Sunday and reach the Soo Sunday night. The convention will open at the Iroquois Hotel Monday morning and continue until Wednesday afternoon, when the party will start on the return trip.

The programme this year will differ somewhat in character from the plan of former meetings. It is proposed to make a special feature of the subject of "Methods of Charging." Four papers will be presented by representatives of the principal Edison companies of the country, dealing with the several features of the problem. These contributions will then be subjected to general debate. Among those who will participate in this feature of the convention are Alex Dow of Detroit, W. S. Barstow of Brooklyn, L. A. Ferguson of Chicago and R. R. Bowker of New York. The subject of meters will also be considered in detail by E. A. Leslie of the Manhattan company of New York, C. D. Haskins of the General Electric company of Schenectady, C. S. Shepard of the New York Edison company and Oliver J. Bushnell of the Chicago Edison company. Managers of small exchanges will be interested in the discussion of "Problems Concerning the Management of Small Stations," for which contributions will be prepared by C. C. Perry of Indianapolis and William Chandler of Sault Ste. Marie. The most important feature of the meeting, it is expected, will be the report of Wilson S. Howell on the work of the lamp-testing bureau which has been conducted by the association for a year and a half. This report will describe the work of the bureau and explain the operation of the arrangement by which the companies comprising the association purchase lamps made under specifications furnished by the association. Mr. Howell is the testing officer of the lamp bureau and secretary of the association. Another important document will be submitted by J. W. Lieb of the New York Edison company. It will comprise the report of the engineering commission of the New York Edison company which recently visited Europe to study recent advances in central-station work in the leading capitals of the old world. Among the visitors at the convention will be Lieutenant S. Dana Greene of the General Electric company. Lieutenant Greene has just returned from the front. He served on the Yankee during the recent war with Spain and performed very creditable work. He will be given a rousing reception by his old friends in Edison circles.

Accidental Explosion of Mine.

The government steamer John R. Meigs was blown to pieces on Saturday last by a mine near Fort St. Philip, 89 miles below New Orleans. Four persons were instantly killed and two were badly injured. The steamer was used in the work of removing mines in the Mississippi. It was an undertaking fraught with much danger, owing to the fact that there is always a swift current in the river, and the water is continually depositing a heavy sediment which buries the cables connecting and anchoring the mines, and, in several instances, these mines have broken loose from their moorings and wandered off, becoming a menace to navigation. Fortunately they were caught before any disaster occurred. Many of the mines were so deeply imbedded in the sand that they could not be removed and had to be exploded. Owing to the danger involved much care had to be exercised and it was slow work. On Saturday morning the boat moved down below the fort, where one of the last remaining mines was placed, and, with the aid of the charts, the officer in charge began hunting it. About 11 o'clock a dull roar was heard and almost instantly the little boat was shattered and those who were not killed were struggling in the water.

Some Suggestions Relative to Determining the Cost of Electric Supply.[1]

By M. E. Turner.

At the National Electric Light association convention in 1897, Mr. Arthur Wright of Brighton, England, read a paper in which was developed a method of charging a consumer for electrical current based on the cost of the consumer to the supply company. The method of determining this cost was but briefly outlined in his paper, so that I take occasion here to go more fully into this method, as it is of the first importance to know the cost of supplying current before any method of charging can be confidently used.

The foundation of this system is the proportioning of all expenses into—

First—Those which are fixed, or those which remain about constant, only changing as the number of consumers increase, or as the territory is extended, or as the number of units in the station is increased, or as the investment is increased. These are termed standing charges.

Second—Those expenses which increase or decrease with the output of the station; that is, the number of kilowatt-hours or horse power hours manufactured.

Before any supply company can determine these costs with any degree of accuracy, a complete record of accounts, with divisions and subdivisions, should be kept. And where the supply company has installed two or three systems, such as low-tension direct, series arc and alternating, these determinations become a little more complicated, but are, therefore, very much more essential, and proper care should be taken to keep as far as possible the investments and the operating expenses of these different systems separate. The losses and the expenses of maintenance for each system are different; therefore the cost will be different. Now whatever method is used for selling current (it may be the same for the different systems based on the average cost; it may be distinct for each system), the cost should be known, or the company may be extending its business along unprofitable lines.

To illustrate this method, I have taken a station operating an Edison system with underground distribution and have divided the total expenses into four general headings, viz., manufacture, distribution, general expense and fixed charges.

Manufacture includes all expenses incidental to the work in the station, such as fuel, water, oil, waste and packing, removal or disposition of ashes, labor, repair and maintenance of engines, boilers, auxiliary engines and piping, electrical machinery, tools, building and incidental expenses.

Distribution includes all expenses of repair and maintenance of underground conductors, tools, meters, inside wiring, etc., and overhead lines.

General expense includes all expenses, such as salaries of officers and superintendents, rents, taxes, insurance, legal and sundry expenses, casualties, etc.

It will be understood that these subdivisions may be arranged in any manner to suit the company's requirements, but enough such divisions should be made to determine by the increment or diminution in these accounts from time to time what part is to be proportioned to the standing and what to the running charges.

Fixed charges include the interest on all outstanding capital and a depreciation item, which is an amount to be charged off against the life of the property.

In the following determinations the depreciation is taken at five per cent. of the cost of the plant.

It is now necessary to arrange these various items into either standing or running accounts. Let us start with "Manufacture." Fuel, you will find, is proportional or nearly so to the kilowatts manufactured. To show this, take the fuel account of your own station for six summer or light months, and for six winter or heavy months; then take the kilowatts manufactured for the first period, and then for the second period. Take the difference in money between the six winter and six summer months, and the difference in kilowatts manufactured for these same periods, and you will find that it has cost you a certain sum of money extra to manufacture a certain number of kilowatt-hours. Dividing the money by the kilowatt-hours, you will find that the cost per hour for these extra kilowatt-hours will be the same or very nearly the same as though the total money for the year were divided by the total kilowatt-hours, thereby showing that the extra kilowatts you manufactured cost as much per kilowatt-hour as a kilowatt-hour cost during a summer or winter month. I wish to say here that there are some stations, where the engines are more economically loaded at some periods of the year than at others, where this will not work out just this way, and the extra kilowatts will not cost as much per kilowatt-hour as a kilowatt-hour in summer. If, for any reason, this is so, part of the fuel should be proportioned to the standing charges. Disregarding the exception, fuel is altogether a running cost.

Next consider water. The fuel and water should be proportional, but the same formula may be applied, and it will be found that the cost of water is proportional to the kilowatt-hours manufactured, and is therefore a running cost.

Next, oil, waste and packing. These items are found to vary more with the number of hours the machinery is run than with the work done or the output manufactured. It takes almost as much of these items to run engines light as heavy, yet about half the expense of these items is due to extra engines run at maximum or to the length of time run. So one-half has been proportioned to standing and one-half to running.

The removal of ashes, being proportional to the coal burned, will be readily seen to be a running

By the same course of reasoning, labor in the

FIG. 4. MODERN CENTRAL-STATION SYSTEM AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—DIAGRAMMATIC REPRESENTATION OF THE CHICAGO EDISON ORGANIZATION

1. Read at the convention of the Ohio Electric Light association, Sandusky, Ohio, August 18, 1898.

station would be placed under the head of standing charges, but as a considerable part of the labor is used in handling coal and ashes and a part in the handling of oil, it has been considered best to place a portion of it under running charges, and in this example I have placed one-half to running and one-half to standing.

Next, take the repair and maintenance of boilers. As these repairs or expenses come irregularly, the formula cannot be applied. By watching closely the repairs it will be seen that quite as much expense is caused by the length of time of use as by the output or power delivered. This is also true with the repair of engines, steam piping, pumps, electrical machinery and the building.

It has been thought best to divide these accounts as follows: Fuel, all to running account; water, all to running; oil, waste and packing, one-half to running, one-half to standing account; ashes, all to running; labor, one-half to running, one-half to standing; renewal and repair of engines, one-third to standing, two-thirds to running; renewal and repair of boilers, one-half to standing, one-half to running; renewal and repair of electrical machinery, one-half to running, one-half to standing; renewal and repair of tools and instruments, all to standing; renewal and repair of piping, one-half to running, one-half to standing; incidental expenses, all to standing; renewal and repair of building, all to standing.

These figures should be made up of a year's expenses. After they have been proportioned, the total of the running expenses should be divided by the total kilowatt-hours manufactured. This will give the running cost per kilowatt-hour, and this cost will be a constant factor.

Under distributing expenses, take the repair and maintenance of underground conductors or overhead lines. A careful examination of the causes of the expense of this work will show that they are neither caused by nor proportional to the output or power transmitted, but are caused by the breaking down of the insulation, due to the pressure carried or by the weather, or by poor workmanship or faulty material, or by like causes. But none or almost none is due to the output transmitted. This is also true with the meter account, the tool and instrument account and the inside wiring account, so that all these expenses are standing expenses.

All of the general expense belongs to the standing charges. Whether the plant operates under heavy or light load, the organization of the company must be maintained, insurance carried, taxes paid, and damages settled. The output might be doubled without increasing these expenses or might be cut in half without decreasing them.

This principle applies unquestionably to the interest and depreciation charges, which are also standing charges.

The next step is totaling of all standing charges. This total standing expense or charge is proportional to the kilowatt capacity installed, and will increase as the size and the capacity of the plant are increased. For, as the engines, boilers, generators and piping are increased, so will the standing charges of these accounts increase, and as the number of miles of underground or overhead lines are increased, so are the expenses of repair and maintenance increased. Now, these standing expenses, being proportional to the capacity, should be divided by the kilowatts installed at the end of the period at which the capital is taken. This gives us the annual standing charge per kilowatt of capacity installed, which, divided by 305 days, gives the cost per day (305 days are taken, they being working days; Sundays and holidays are excluded).

In order to apply these principles and to show what a large proportion of the total cost the standing charges are, let us take the example referred to before. We will assume the cost of plant, station and lines to be a capital cost of $500 per kilowatt of station capacity installed. We will assume the sum of all the running charges to be one cent per kilowatt-hour. This sum is derived from the following items mentioned: All of fuel and water; one-half of oil, waste and packing; all of ashes; one-half of labor in station; two-thirds repair of engines; one-half repair of boilers, electrical machinery and piping.

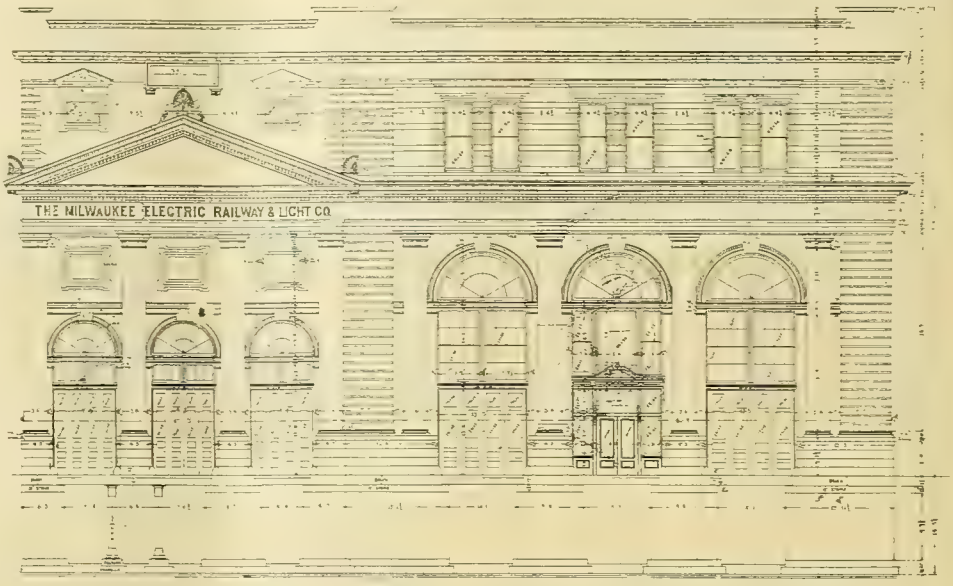


FIG. 1. NEW MILWAUKEE RAILWAY AND LIGHTING STATION.—ELEVATION ON ONEIDA STREET.

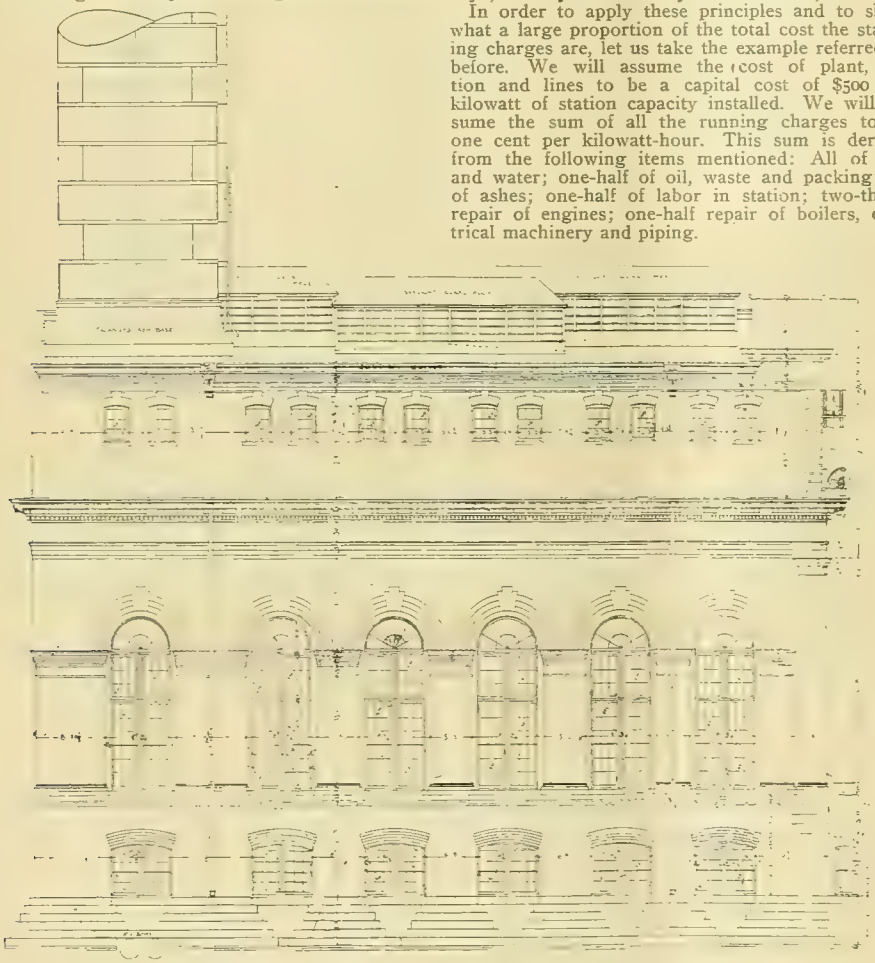


FIG. 2. NEW MILWAUKEE RAILWAY AND LIGHTING STATION.—RIVER FRONTAGE.

The standing charges, without going into detail, are: Manufacture, $7 per kilowatt capacity per annum; distribution, $3; general expense, $17; interest at six per cent., $30; depreciation at five per cent., $25.

This gives us a total standing cost of $82 per annum for each kilowatt capacity we have installed, or, in other words, a cost to us of $82 per year for each kilowatt capacity we keep at a customer's disposal, whether we generate for this customer current from this apparatus for one hour or for 24 hours per day. Next, dividing $82 by 305 days, gives us 26.9 cents per day. Now, if the consumer uses one kilowatt capacity, his cost to us would be 26.9 cents, divided by the number of hours used, plus the running cost. For instance, for one hour's use it would be 26.9 plus one cent, or 27.9 cents; for two hours' use it would be one-half of 26.9, or 13.45, plus one cent, or 14.45 cents per hour.

Discussion.

Mr. Scovil: The general purpose of that paper, I take it, is simply to indicate that there is a great deal of business which an electric-light station does not properly want; that anybody who wants to use current on Saturday nights only, or for one hour a day, is better off your station, using Welsbachs; and the sooner you realize that fact the better you will be off, in my judgment—unless it incidentally leads to other business. We have lately installed in Cleveland the practice of charging for current on the basis of 12½ cents per unit for the first two hours' use of the demand which the customer makes upon the station, and after that two hours' use we sell him all the current he wants for five cents. The result is, the more hours' use a man makes of his demand, the better rate he gets. We are having a certain amount of "kicking" from certain people who had pretty large bills, and who under the commercial discount got a large discount, and are now getting no discount. It is arousing a great deal of trouble. But I have learned that we cannot afford to put in machinery from year to year for the purpose of advertising somebody's business Saturday night. The more you consider this subject, the more will you be convinced that a certain kind of business is an absolute loss; you don't want it! That conclusion will be forced upon you; you can't get away from it.

You can make current for, say, one cent—you will each have to determine your own running cost—but there is a certain fixed cost it means to you, and every time you have to increase your station to take care of that for such a customer, if he doesn't make sufficient use of it for you to get a profit out of it, you don't want it. We have all got to learn that lesson.

Mr. Holmes: I realize the truthfulness of what Mr. Scovil has said, and of what has been shown in the paper, but there is a great deal in the fact that there is an incidental advantage in the use of the electric light. I think last season we put in probably 3,000 lights, used largely on Saturday night through the holidays, and it was pretty discouraging business. We had to stop trying to put in any more business before the winter was over. The result was, we had to spend thirty or forty thousand dollars.

I have always been fighting that principle of using lights for window display; but one of our townsmen got the idea there was lots of money in electric lighting, and he put in a little plant. He thought that his business hadn't been properly attended to. He encouraged wiring up of windows for nothing. We had some customers we didn't want to lose, and while we didn't want any wiring for nothing we took some of that business; and the more we took the more we had to take. We have learned, however, that it has led to a more general use of the light. Our other business is growing larger, so I think in the long run we will come out all right.

I would like to ask if the Wright system of measurement is adopted anywhere? Let us have a general idea of it.

Mr. Scovil: The Wright system, as adopted in Brighton, is a two-rate system, and it has been adopted pretty largely throughout England, on the

[*Continued on page 151.*]

New Milwaukee Railway and Lighting Station.

Work is now proceeding on the new power station of the Milwaukee Electric Railway and Light company on the site at River and Oneida streets, adjoining the old plant and having a frontage on the Milwaukee River. The building has ground dimensions of 130 by 100 feet and is two stories high. The front or Oneida street elevation is shown in Fig. 1, and the river frontage, showing the stack, in Fig. 2. Fig. 3 is a plan of the first floor, containing the engine and boiler rooms, and Fig. 4 gives a sectional view of the building and machinery. The plant is an addition to the existing equipment, but is designed as a complete station for generating current for the company's railway feeders and electric-light circuits.

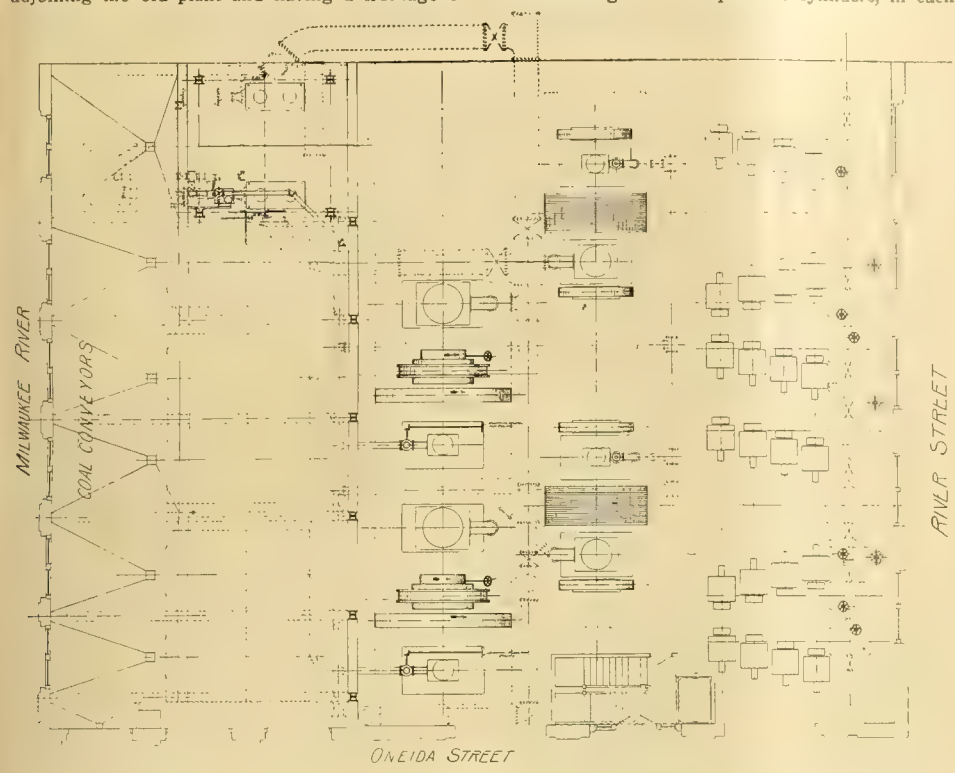


FIG. 3. NEW MILWAUKEE RAILWAY AND LIGHTING STATION.—PLAN OF BOILER ROOM AND ENGINE ROOM

The foundations for the building and machinery rest on piles, which are capped by a bed of concrete from two to three feet thick. The building itself is a skeleton framework of iron with large window spaces and brick veneering for the side walls. The roof is of the usual truss construction and is covered with tiles. The main entrance is on Oneida street, and, as some decorative embellishment is used, the station presents a rather attractive appearance. The general arrangement is well shown in Fig. 4. The greater part of the space in the building is devoted to the plant, but on the second floor, over the engine room, there will be the offices of those officers of the company actively engaged in the supervision of the station, store rooms, workshops and the like. In the basement lockers and toilet rooms will be provided for the hands employed about the plant.

Coal will be brought to the new station by the river, and will be unloaded from boats and transferred to the coal bunkers in the upper level of the boiler room by steam shovels. Coal conveyors or chutes will distribute the fuel from the bunkers to the furnaces under the boilers by gravity. A complete outfit of ash-handling machinery will also be installed.

There will be five water-tube boilers, with 18-foot tubes and a combined capacity, rated on the basis adopted by the American Society of Mechanical Engineers, of 4,000 horse power. These boilers will be supplied by the Edgemoor Iron company and they will be fitted with chain-grate furnaces made by the Green Engineering company of Chicago. A large Green economizer, made by the Fuel Economizer company, will be placed above the boilers. This economizer will be of sufficient capacity to raise the feed-water to a temperature of 300°. Two Blake jet condensers of 7,000 horse power capacity each will be installed. It is interesting to note that these condensers are of the same size as those in duty on the crack German transatlantic liner Wilhelm der Grosse and of similar design. The three boiler pumps will be of the Admiralty type. They will take the water from the hot well of the condensers and deliver it through a closed heater, into which all the pumps and steam accessories will exhaust, to the economizer, whence it will be piped to the boilers.

The stack will be of iron and circular in shape. It will extend 200 feet above the grate bars and will be 16 feet in diameter at the top. It will be self-supporting and lined with firebrick.

In the engine room there are four large vertical compound condensing Allis engines, arranged in two groups of two each, as shown by the drawings, Figs. 3 and 4. The two large engines are direct-connected to railway generators and are capable of developing about 2,500 horse power each. The generator and flywheel are on the main shaft, between the high and low-pressure cylinders, in each case. The flywheel is 20 feet in diameter, and weighs 150,000 pounds. The generator is the standard machine built by the General Electric company for direct connection. It has a rated output of 1,000 kilowatts and is wound for 600 volts.

The two lighting engines have a maximum capacity of about 1,600 horse power each. They are both direct-connected to two General Electric direct-current multipolar incandescent dynamos of 200 kilowatts each, wound for an electromotive force of 125 volts. There are four of these machines, and they are supported on outboard bearings on the engines, in the position shown in the plan, Fig. 3. In addition, these engines drive 24 arc dynamos by rope drives to a line of shafting in the basement, whence the power is taken to the arc machines above by belts. The driving sheave of each engine is placed between the cylinders, as shown in Fig. 3. It is 15 feet in diameter and weighs 70,000 pounds. The shaft in the basement is 100 feet long. The arc dynamos above it are arranged in six groups of four each. Each group is operated from a clutch pulley on the shaft. The arc machines will be 100-lighters.

An overhead electric traveling crane will traverse the engine room. It will have a lifting capacity of 30 tons and a span of 77 feet, traversing the entire depth of the room. It will be equipped with three motors. The main driving motor is specified to have capacity sufficient to propel the crane and load on its runways at a minimum speed of 200 feet a minute. The cross-travel motor must carry the load crosswise at a minimum speed of 75 feet a minute, and the lifting motor must be powerful enough to hoist the maximum load of 30 tons 10 feet a minute.

Lubrication of the engine and other machine bearings is accomplished by the employment of the gravity system. A small duplex oil pump forces the oil from a filter in the basement to a reservoir in the economizer room. From this elevation the oil descends by gravity through pipes to the bearings. After use it is returned to the filter in the basement, to be strained and again sent on its round.

In every direction the economies of the modern power station are observed. Returns of all high-pressure steam drips will be made to the boilers by the Holly system. A compressed-air equipment, including a Westinghouse compressor and a receiving tank, will be installed to supply compressed air for blowing the dust from armatures, switch contacts, etc.

The switchboards are not shown in the drawings, and their location has not been definitely decided. They will be erected on a gallery 10 or 12 feet from the floor, and there will be three of them—one for the railway generators and feeders, another for the incandescent lighting and the third for the arc circuits. The last-named board will have 10 panels. The boards will be equipped with edgewise instruments.

It is hoped that the plant will be ready for operation on or about January 1st. When completed the station will be a large, complete and exceptionally interesting one. The designing and constructing engineers are Sargent & Lundy of Chicago.

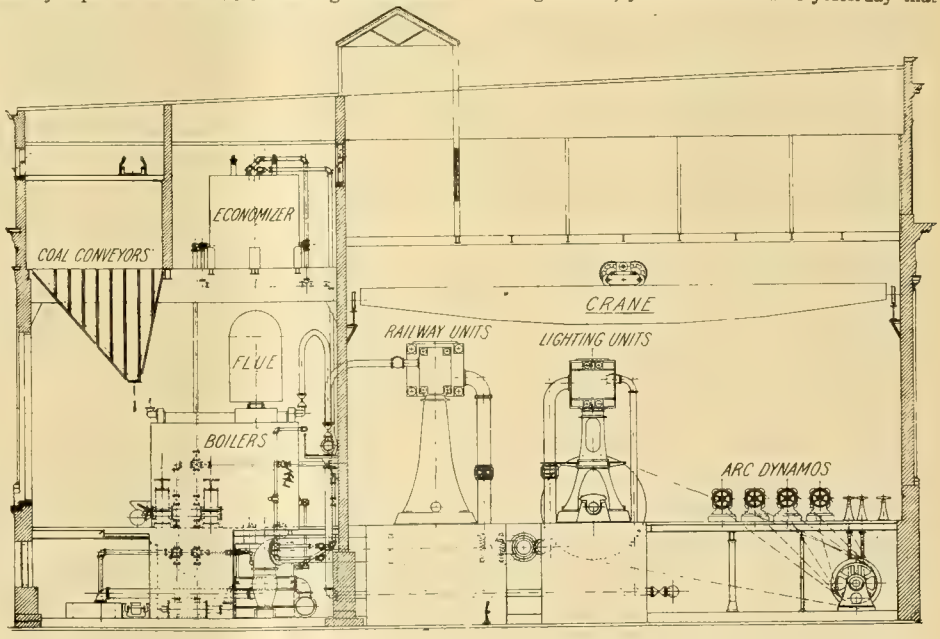


FIG. 4. NEW MILWAUKEE RAILWAY AND LIGHTING STATION.—SECTION THROUGH BOILER ROOM AND ENGINE ROOM.

Western Society of Engineers.

The announcement of the Western Society of Engineers for the coming season shows that arrangements have been made for several papers on electrical subjects. Professor Jackson will discuss "Electrolytic Corrosion of Underground Metallic Structures" on December 7th, and "Brakes for Electric Cars" will form the subject of a paper by William G. Price on November 2d. The committee on professional papers includes the following-named gentlemen: T. L. Condron, chairman; general engineering, Thomas Appleton and Ira O. Baker; municipal engineering, J. H. Spengler and J. A. Harman; mechanical engineering, C. E. Billin and T. W. Snow; electrical engineering, H. M. Brinckerhoff and D. C. Jackson; hydraulic engineering, W. G. Price and L. M. Mann; architectural engineering, Dankmar Adler.

Pacific Cable Needed.

[From the Chicago Record, August 24th.]

The flag-raising exercises took place at Honolulu on August 12th, yet it was not until yesterday that the fact was made known to the people of the United States. This demonstrates the necessity which exists for a cable connecting Honolulu with the American continent, in order that the government and people of this country may keep in touch with their newly acquired possessions in the Pacific. A cable, extending not only to Honolulu but to the Asiatic coast, is one of the pressing needs emphasized by the war and by the annexation of the Hawaiian Islands. Congress must give its early attention to this matter.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The Edison convention which will be held at the Soo next week will be an important event among the enthusiastic band of engineers who are engaged in operating the 70 central-station plants of the country employing the Edison system. The practical character of the work of these meetings commends the association to the management of Edison stations. No doubt the Soo meeting will be in keeping with the record of the organization.

The American Street Railway association held its annual convention during the week at Boston, where the organization was formed in 1882. It is a much more powerful force now than the promoters anticipated—in fact the business has made such wonderful strides in the intervening years that it is hard to realize that so much has been accomplished in such a short period. There is still much to be done. The association seems to be equal to any task imposed upon it, thanks to the intelligent and progressive management that has marked its career.

A New York "inventor" has patented an "elevated railway," the distinctive feature of which is that there are two sets of rails, one above the other, and that the cars are equipped with double sets of "traction wheels secured respectively to their top and bottom surfaces, the top set of traction wheels adapted for engagement with the lower set of rails for suspending the car and the lower set of traction wheels adapted for engaging the upper set of rails, for supporting the car, whereby the car may be alternately supported upon the upper rails or suspended from the lower rails," according to the language of the patent. It seems too bad that valuable time which might be utilized to advantage must be devoted to consideration of such claims as those presented in the specification.

Experienced street-railway men are divided in opinion on the question of the advisability of establishing and maintaining pleasure resorts and entertainments on the routes of street-railway lines for the purpose of attracting crowds and thus securing patronage during the dull season. It seems to be the general impression that when the expense involved is slight, such an enterprise will prove advantageous, but where it is necessary to make special provision to take care of the crowds or where an increase in the capacity of the plant is demanded the enterprise may prove a source of heavy expense without corresponding returns. In Chicago there are few points of this kind. The electric fountain at Lincoln Park continues to attract people from all parts of the city and many visitors from other places, but it is noticed that the number of riders of bicycles among the spectators is increasing every week. The summer gardens near the end of the car lines are another source of profit to the transportation companies. Probably the most important movement in this line is the establishment of a casino on the South Side. The Chicago City Railway company will encourage the enterprise and lend it financial support, more in the nature of an experiment than otherwise, but it will not be identified in any way with the management nor will it assume any responsibility.

The general subject of street-railway companies supporting enterprises of this character was made a feature of the programme of the American Street Railway association convention at Boston this week. The experience of other cities, as related in the discussion, will no doubt prove of absorbing interest to the Chicago officials.

Hard times are forgotten and good feeling prevails everywhere. An examination of the condition of trade during the month of August justifies the conclusion that the country has really entered upon an era of prosperity and that the advent of cooler weather will be marked by a strong and steady improvement in all lines of trade. Reports of the commercial agencies support this view, and the iron market particularly offers encouragement. In Bradstreet's report, for instance, it is noted that "The advent of September finds fall trade apparently in full swing at the West and Northwest and more reported doing at southern Mississippi valley points and in the East." It is also mentioned that "Reports from the iron and steel trade are in a high degree favorable, the tonnage movement being unprecedentedly large and the tone of prices firm at the advances recently scored." The same tone of encouragement is apparent in Dun's report. It is announced that the smallest number of failures ever recorded in any month for five years was that of August, 171, against 191 last year. The clearings have been the largest ever known in August, and 23 per cent. larger than in 1892. This enormous volume of business in a month, usually one of the most inactive of the year, is explained in the following manner: "Postponement during the months of war of some contracts and purchases which have now come forward explain part of the increase, and the strong absorption of securities explains part, but there has also been a great decline in the average of prices for all commodities, so that it takes a much larger volume of business in tons or bushels to make up transactions amounting to a million more than in 1892. It is, therefore, strictly true that business is larger than in the very best of all past years, and yet there is every prospect of much further increase." This is certainly an encouraging condition of affairs and cannot fail to influence the electrical industry favorably. Aside from these general reports there is evidence at hand that there is a marked revival in the trade. The excellent character of American electrical machinery has received such general recognition abroad that there is reason to expect a much larger demand this year than ever before and a constantly growing market for American products.

Lieutenant M. L. Bristol of the Texas believes that the searchlight and telephone have proved the most valuable parts of the electrical equipment of modern battleships in the recent war with Spain. In the course of an interview he expressed the view that "electrical appliances of the modern warship and in the various auxiliaries of up-to-date warfare cannot be said to have had a fair trial as yet," and he added: "Certainly they have not been of any great use in either of our big sea fights, although this is not saying that they might not be of the greatest importance under other circumstances."

Concerning some of the wild statements that were attributed to "eminent inventors" and others equally eager for notoriety, the officer says that none of them were considered of sufficient importance to deserve a trial. The experience gained with submarine mines was valuable, but it showed that in tropical countries at least they required overhauling every month to prevent the growths common in those waters to impair their usefulness. One statement of Lieutenant Bristol is particularly interesting. He says:

It is a striking fact that the carefully contrived range finders and other delicately poised appliances for improving the accuracy of a ship's fire seem to have been forgotten in the heat of the conflict. So far as I have heard, the guns of the Oregon were sighted and fired in the old-fashioned way. I know that those of the Texas were, for the simple reason that our guns are not fitted with range finders. We used the stadimeter to determine the range and sighted the rapid-firers just as used to be done with the old-style gun. And yet I think that for accuracy of fire the work of the Texas' gunners left little to be desired. This, of course, is not saying that the range finder is not a most useful instrument, especially for long-distance work, but merely that it was not brought into play in the Santiago fight nor in the battle of Manila, which was fought at even shorter range.

Referring to the use of the searchlight, particularly during the blockading of the harbor of Santiago, Lieutenant Bristol says that it would have been an impossibility for the Spanish commander to sneak out under cover of darkness, as some of his critics have suggested he should have done. "The electric searchlight may be put down on the list as one of the modern improvements which have really a practical value in war. The telephone is another electrical contrivance which has proved of effectual use in the recent operations. Its utility, like that of the searchlight, the great value of smokeless powder and the effectiveness of the megaphone, have been demonstrated in this war quite as unmistakably as the force of the big gun and the destructiveness of the secondary battery. But the wonderful new mine cables, boats running on wheels at the bottom of the ocean, the flying torpedoes and the current of electricity projected along a column of water, of which we read before the war, are as much in the future as ever."

Lieutenant Bristol doubtless voices the sentiment of a majority of the naval officers, and it may be inferred from his statement that he believes these "wonders" will never materialize. Many of the plans that have been given widespread publicity are so absurd that it is really wonderful that they should attract any serious consideration.

BOSTON MEETING

Of the American Street Railway Association.

[Special dispatch to the Western Electrician.]

Boston, September 7.—In many respects the meeting of the American Street Railway association in this city is a noteworthy gathering. In point of attendance it is certainly the most successful convention that has yet been known, and it is a significant fact that every officer and member of the executive committee was present at the opening session yesterday morning.

Boston extended a cordial greeting to the visitors and the event promises to be enjoyable in every respect. The local street-railway interests have left nothing undone to insure the comfort of the members during their sojourn in this city, and the association officials have provided a programme for the meetings which will interest every delegate.

Out-of-town members began to arrive on Monday, and soon there was a fair representation. The western contingent, which reached the city in the afternoon, was warmly welcomed. It proved a valuable acquisition to the convention. Chicago was especially well represented. A party of 51, including street-railway men and their families, left Chicago Sunday on the Continental Limited of the Wabash system, in charge of N. C. Keeran, and arrived at the destination on Monday afternoon at 5:50 o'clock. This party included the following-named ladies and gentlemen:

D. A. Belden.
E. R. Harding.
R. F. Carr.
A. C. Heidelberg.
C. L. Jones.
Clift Wise.
George O. Nagle.
F. A. Lawson.
C. P. Wilson.
D. H. Goodrich.
W. P. Casper.
J. Z. George.
Charles J. Reilly.
B. J. Jones.
James A. Brett.
Maurice Coster.
Frank H. Clark.
J. A. Hanna.
H. M. Sloan.
F. R. Greene.
W. S. Dimmock.
E. Laird Keeran.
A. W. Soper.
Clement C. Smith.
H. C. Mackay.
T. E. Mitten.
George F. Rooke.
W. F. Carr.
W. T. Van Dorn.
W. H. Forsyth.
C. E. Moore.
J. J. O'Keefe.
J. Miller.
C. K. Knickerbocker.
F. B. Macomber.
James Atkinson.
E. A. Wurster.
H. T. Bigelow.
F. A. Dolbh.
S. W. Watkins.
George C. Bailey.
Elmer E. Hartzell.
William Walmsley.
C. S. McMahan.
Frank L. Perry.
W. J. Cooke, wife and daughter.
N. C. Keeran and wife.
George Weston and wife.

Most of the visitors took occasion to inspect the power plants of the street-railway system and ride through the subway. The northern division of the subway was inspected by about 200 legislators and other prominent men on last Wednesday, and was opened to the public on Saturday, thus bringing the whole of the subway into use. The total length is about one and one-third miles and the total length of single track five miles. It has been constructed well within the original appropriation of $7,000,000, and forms the first step in Boston's comprehensive rapid-transit system, which includes a tunnel underneath the harbor to East Boston and elevated lines connecting with the subway.

The convention building, in which the exhibition of street-railway machinery is being held, came in for early attention. As usual the exhibits were not arranged before the opening of the convention and everything was in a turmoil. Judging from the display that is already made by several large companies and the preparations that other concerns have made, the exhibition will be in keeping with the importance of the event. Everything will be completed to-night, and it is probable that many of the exhibitors will leave their apparatus in place during the Mechanics' Institute, which follows the American Street Railway association meeting.

When President Lang called the convention to order at 11 o'clock Tuesday morning there was a large attendance, and several former presidents of the association occupied seats on the platform. Mayor Quincy, on behalf of the city, extended a cordial greeting to the visitors. President Lang responded on behalf of the association. Speeches were made by prominent members.

In the regular order of business the calling of the roll and extending invitations to join the association occupied considerable time. The address of the president and the reports of the executive committee and the secretary and treasurer completed the order of exercises so far as routine business was concerned.

The first paper on the programme was on "Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use." It was prepared by Richard McCulloch, electrical engineer of the Cass Avenue and Citizens' Street Railway companies of St. Louis, Mo., and was discussed by John I. Beggs of Milwaukee.

At the conclusion of the morning session the convention adjourned for the day. After luncheon a trip to Concord and Lexington occupied considerable time, and in the evening there was a reception at the hall.

To-day's meeting was devoted to the consideration of two very interesting and able papers, both of which were discussed in all their bearings. The first was on "Maintenance and Equipment of Electric Cars for Street Railways," by M. S. Hopkins, electrician for the Columbus Street Railway company of Columbus, Ohio, and the other was entitled "Carrying of United States Mail Matter on Street Railways," and was presented by W. S. Dimmock, general superintendent of the Omaha and Council Bluffs Railway and Bridge company of Council Bluffs, Ia.

The appointment of a committee on nomination of officers and selection of next place of meeting concluded the second morning's session. The committee was composed of the following-named gentlemen: W. W. Bean, chairman, D. G. Hamilton,

A. B. DU PONT, GENERAL MANAGER DETROIT CITIZENS' STREET RAILWAY COMPANY.

E. C. Foster, W. F. Kelly, J. R. Chapman, Henry C. Payne and O. H. Davis. An invitation to attend the New York State Street Railway association convention at Manhattan Beach was received. Invitations were also received from Detroit and Kansas City for the next meeting.

The Accountants' association is in session here. Several important papers have been read. The organization seems to be gaining influence. F. L. P.

Detroit Invites Street-railway Men.

During the last two years there has been a feeling on the part of the street railway men of the West that the convention of the American Street Railway association should be held in a western city, at least west of Buffalo. At Niagara Falls this sentiment was developed, but it was found that Boston had made elaborate arrangements for this year's meeting; and as the birthplace of the organization had never been honored by the association meeting, it was decided to withdraw all opposition.

Now, however, there is a revival of the feeling that the West should be honored. Detroit, particularly, has been anxious to secure the meeting. Several weeks ago representatives of the leading merchants of the city communicated with Secretary Penington on the subject, and he advised them of the necessary steps that must be taken. Of course it was necessary that the Detroit street-railway men should extend the invitation to the convention, and the business men backed up this offer with an urgent request. The manager of the Detroit Citizens' Street Railway association is A. B. du Pont, an experienced street-railway man, who will have charge of the arrangements should the convention go to Detroit next year. The city has an admirable exhibition hall, which is an essential feature of the annual meeting.

Detroit's Electric Railways.

[Special Correspondence of the Western Electrician.]

Detroit, September 7.—The city of Detroit is gradually being hemmed in by electric railways. Lines are, or will be, built on every road entering the city. The Detroit, Lake Shore and Mount Clemens Railway company formally opened its line on Thursday, September 1st. A motor car was run on the Jefferson avenue line of the Citizens' Street Railway company, making the trip to Mount Clemens in one hour and 30 minutes. The company is running only one car at present and makes the round trip in three hours. When everything is in smooth running order the time will be cut down an hour. There are 10 cars now being equipped with motors. By next Monday some of these cars will be in operation. Next summer this line will run through to the St. Clair flats, the fashionable summer resort of Detroit. The total distance covered will be about 75 miles and the round-trip rate will be 50 cents. The road will be operated in conjunction with the boat lines, tickets from one being good on the other.

The Detroit, Ypsilanti and Ann Arbor Railway company commenced using its own power house on September 5th. The building is at Dearborn, nine miles from Detroit. Work on the structure was delayed owing to the war, as machinery could not be secured. The company is now giving a half-hour service and the trip from Detroit to Ann Arbor is made in two hours.

The Dearborn company expects to complete its line to Dearborn out Fort street by October 1st. A force of 100 men is now laying the track and stringing wire.

Another desirable addition to the Detroit suburban electric lines is the Detroit, Plymouth and Northville Electric Railway company's system, on which cars will be in operation in about two weeks. The line connects with the Detroit, Ann Arbor and Ypsilanti road at Wayne and runs north to Plymouth and Northville. The total distance of the route is 14 miles. The managers of this road claim that the construction will be first-class in every respect. The power plant will be located at Plymouth, and will include two 125 horse power boilers, two Dick & Church engines and two electrical generators of 100 kilowatts capacity each. The entire plant will be in duplicate. The equipment of the new road will include four 36-foot passenger coaches, each equipped with two 35 horse power motors and the usual number of freight, gravel and construction cars. The grading of the road was completed last week. The track and overhead equipment is already on the ground.

The Grand River railway, which runs from the city limits, through Roseville to Sand Hill, a distance of nine miles, has been in operation since August 15th. Next spring the road will be extended to Farmington, a distance of seven miles, and to Orchard Lake, a further distance of 14 miles. At Orchard Lake it will connect with the Pontiac and Sylvan Lake railway, and the company will then control 33 miles of track.

It is reported that the Michigan Central Railroad company will build an electric line from Detroit to Ann Arbor next spring to compete with the Detroit and Ann Arbor road. The electric line has taken away nearly all the Michigan Central's suburban businesss.

Metropolitan "L" Improvements.

Within a month, if all goes well, express trains will be run on the Metropolitan elevated railway of Chicago. By the new order several new trains will be added to the schedule. They will make stops only in the heart of the city and will be run to Douglas, Garfield and Humboldt parks and Logan square. Under the new schedule trains will be run six instead of eight minutes apart. The company has just received eight new motor cars, which will be put in the "express" train service. In these cars the motor compartment has been set back into the body of the car, which leaves a clear platform across the entire end of the car. This will make it easier for the loading and unloading of passengers.

At the power house, Throop and Loomis streets, workmen are busily engaged. The west end of the building has been entirely torn out and new foundations put in for the new machinery made necessary by the increasing of the number of trains and the increased power necessary for the handling of them. New tracks are also being constructed, so that trains can pass better and with greater safety.

Dickinson MacAllister, receiver for the company, says that when all of the proposed new trains have been put on the Metropolitan company will be running about 1,200 trains every 24 hours. The receiver was authorized to spend $146,210 in making the improvements.

The Navy Department, through the Bureau of Yards and Docks, is inviting sealed proposals until September 24th for installing an electric light and power plant at the United States navy yard at Pensacola, Fla. Specifications and blank forms of proposals will be forwarded upon application to the commandant of the navy yard at Pensacola, or to the Bureau of Yards and Docks, Washington, D. C.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Keystone Telephone company has made a proposition to Scotland, S. D., to put in an exchange there.

The Minnesota Central Telephone company has completed connection with New Paynesville, Minn.

A farmer named Brown has enjoined the Northwestern Telephone Exchange company near Nicollet, Minn., from stringing wires across his farm. The company had a right-of-way three feet from the railroad track, but it was impracticable, and the company proposed to cut across.

The Harrison Telephone company of Deadwood, S. D., protested before the state board of equalization on its assessment of $125 per mile of poles, but without avail, for the board made no change.

The Harrison Telephone company has put in a new switchboard at Spearfish, S. D.

The telephone system in New Richmond, Wis., is completed and operating.

A police telephone system is in contemplation in Superior, Wis.

The Nicollet County Telephone company has completed its lines from St. Peter, Minn., to Bernadotte and other points.

The Boone County Telephone company has completed a line to Marshalltown, Ia.

The Sibley County Telephone company held its annual meeting at Arlington, Minn., recently. The gross earnings were $527.

The Houts Telephone company will soon connect with Merrill, Ia.

Superintendent Brooks of the American Telephone and Telegraph company of Chicago was a visitor in St. Cloud, Minn., recently.

The Wisconsin Telephone company has its new exchange office in Rhinelander, Wis., in operation.

The Jefferson County Telephone company will extend its wires to Brighton, Ia.

The Waterman-Slaughter Telephone company has reached Bussey, Ia., from the south, and the Knoxville Electric company from the north.

A central exchange will be established in South Ottumwa, Ia., with 100 instruments.

The Iowa Telephone company is about to modernize its exchange in Sioux City, Ia., at a cost of $50,000.

The telephone company in Duluth, Minn., was recently given permission to erect telephone poles along First street from Ninth to Fifteenth avenue. Citizens protested vigorously and the permit was revoked. There is a strong suspicion that the company is trying to strengthen its position for holding on after the expiration of its franchise, which occurs in eight months.

The Rocky Mountain Bell Telephone company is working on its line to Wallace, Idaho, and expects to have it completed in October.

W. J. Bell, manager of the Baraboo Telephone company of Baraboo, Wis., is nursing two broken ribs and numerous other bruises as a result of his horse disturbing a hornet's nest. The animal then ran away, and as Mr. Bell was not looking for any such demonstration, he was unprepared and fell out of the vehicle backward. He has been struck by lightning, fallen from high poles and had several other severe accidents.

The Vernon and Nelson Telephone company has completed its lines between Spokane, Wash., and Greenwood City, B. C.

The Inland Telephone company is building a line into Colville, Wash., and is preparing to establish an exchange, without having a franchise.

The assembly in St. Paul has granted the Mississippi Valley Telephone company the right to construct wire conduits on Central avenue and on St. Peter street, and to erect poles and wires on Central, Fairview, Prior, Cleveland and St. Anthony avenues.

The Midland Telephone company, which was incorporated recently at Worthington, Minn., will construct lines between Ellsworth, Adrian, St. Kilian and Worthington.

The Nicollet County Telephone company of St. Peter, Minn., has completed its lines to Traverse, Lake Prairie, New Sweden, Norseland, Bernadotte and Winthrop.

Traer, Ia., now has connection by telephone with Dinsdale, Reinbeck and Dysart, Ia.

Wayland and Winfield, Ia., now have connection with Mount Pleasant.

The Iowa Telephone company has removed its central office in Keokuk, Ia., to new quarters.

Some farmers between Grand Forks, N. D., and Fisher, Minn., refused the offer of the Northwestern Telephone Exchange company of $50 per acre for a right-of-way. The board of appraisers decided the damage to be but $35.

The Iowa Telephone company is rebuilding its line from Carroll, Ia., to Logan.

W. S. Murray, manager of the Rocky Mountain Bell Telephone company, at Salt Lake, Utah, purchased the telephone exchange of the Electric City Telephone company at Great Falls, Mont., last March. As the terms of the franchise made it impossible for the company to sell out to a competitor, except with the permission of the council, the purchaser has applied for the required permission. There is a suit pending in court on the part of some of the stockholders to set aside the purchase. The council is inclined to take no action until the matter is out of the courts, and the plea of the Rocky Mountain company that it would erect a large building in Great Falls if given permission made no impression.

The Watterman Telephone company of Ottumwa, Ia., has compled a line from Hiteman to Marysville.

The Iowa Telephone company has completed connection with Rutland and Bradgate, Ia.

Forest fires destroyed three miles of the telephone line between Spokane, Wash., and Republic, B. C.

Jones & Winter of St. Paul secured the contract to install the telephone exchange for the Fort Dodge Telephone company of Fort Dodge, Ia.

The Iowa Telephone company has been granted a franchise at Washta, Ia.

The Mutual Telephone company of Indianola, Ia., has over 100 subscribers and has been compelled to enlarge its switchboard.

The Minnesota Central Telephone company's wires have reached Buffalo, Minn.

The new telephone exchange at Worthington, Minn., has been opened with 100 instruments in use.

The Badger State Long-distance Telephone company has completed its lines from Baraboo, Wis., to Kilbourn, 14 miles.

The Tri-city Telephone company at Clinton, Ia., has put in a 600-drop switchboard.

The Wisconsin Telephone company will have its exchange in Rhinelander, Wis., in operation at an early day. Charles Chalee and others have been granted a franchise for an independent telephone exchange in the same town.

A telephone exchange will be established at Hillsboro, N. D., for the Hillsboro, Duane, Caledonia and Shelly telephone line.

A new telephone company is seeking a franchise at Le Mars, Ia.

The telephone company at St. James, Minn., has nearly 100 instruments in use in that town.

The Midland Telephone company has connected with Oakes, N. D.; Frederick, S. D., will be connected with, and from there the Twin Cities will be reached over the Dakota Central and Minnesota Central Telephone companies' wires.

Telephony Abroad.

The telephone service of Cape Colony, which is under the control of the colonial government, comprises 1,535 instruments in use, and the revenue for 1897 amounted to $66,137.22. There are 869 miles of wire. In the course of the next few months the underground cable system in Cape Town will be completed and exchanges established in the suburbs.

At the present time seven exchanges in the colony work on the single-wire system, but arrangements are being made to have all lines duplicated, and in future no exchange will be established except on the metallic-circuit system. The last report showed that there were 780 subscribers served by this system.

Telephonic communication between Moscow and St. Petersburg is likely this year to become an accomplished fact. The project is under the control of the Imperial Telegraph Department, and the stations will be at the chief telegraph office in either capital. As the average speed of ordinary telegrams between Moscow and St. Petersburg, a distance of 400 miles, is about 10 or 12 hours, the telephone should prove a great boon to business men, who, in case of urgency, are now obliged to pay three times the ordinary tariff to get their telegrams through as "special" messages.

Recent telephone statistics have been gathered in the German empire, for Prussia, to October, 1897, for Württemberg to April, 1897, for Bavaria to January, 1897. The general aspect is certainly satisfactory, as a few numbers referring to 1897 and 1894 (in parentheses) will sufficiently indicate. There were 632 (461) towns or places, with 164,681 (110,894) telephone stations and 240,127 (154,435) kilometers of lines, on which 1,440,657 (1,078,865) conversations took place daily. The long-distance lines had a length of 90,512 (48,627) kilometers, and 191,884 (129,256) conversations passed over them. Particular notice is called to the strong increase in local telephone lines and the business done on them, which mainly affects smaller towns, and, further, in the long-distance connection. The longest of these is the Memel-Berlin line, 1,012 kilometers (625 miles) in length, which was used 134 times daily. The Berlin-Budapest line is only very little shorter, 969 kilometers; Berlin-Vienna and Berlin-Münich is 600 miles. The record shows that 450 new interurban lines are now being erected. There was last year one telephone station for every 318 inhabitants; Frankfort-on-the-Main had one for 45 inhabitants, Berlin and Hamburg one for 46. Frankfort-Mannheim is now putting up the fifth metallic loop line. The farmer has little need for urgent communications. In vast tracts of the north and east, and also of Bavaria, the telephone still seems to be unknown.

The Long-distance Telephone.

[From the Railroad Gazette.]

The use of the long-distance telephone has diminished passenger travel on the railroads. The extent of the loss suffered by the railroads is not very well known, and the importance of it is not admitted by all; but the newspapers have now and then given certain definite statements from well-informed men, like that published in the Railroad Gazette two weeks ago, and there can be no question that the value of the telephone is increasingly appreciated. Another bit of significant evidence, reported to us on good authority, is the statement of a railroad officer that the business of one of the limited trains between New York and Chicago has been practically ruined by the telephone. This comes from the chief executive officer of "one of the lines interested," and as there are only four or five roads interested in these trains the reader can perhaps guess where the statement comes from.

This result is not very surprising. One of the definite objects had in view in putting on 25-hour trains between New York and Chicago was the accommodation of brokers and businesss men of Chicago and the Northwest, who demanded quick time. Their trips to New York were taken on occasions of utmost importance, when a little time meant thousands of dollars. By means of the "limited" the broker or business man was taken to New York in the quickest possible way. He talked as fast as he rode and made an equally quick return to Chicago. The business man was willing to pay the price assessed for this development in rapid transit.

The patronage of people whose time was less valuable to them was not expected to contribute much to the income of these trains, so that their whole dependence was expected to be, and was, on two classes: the business men aforesaid and pleasure travelers to whom a few dollars extra was not a noticeable item. Then came the introduction of the long-distance telephone. People at first were slow in realizing its benefits. Slowly but surely they have, however, came to appreciate its significance. A broker or grain dealer in Chicago has in mind a "big deal;" he telegraphs to New York asking for certain information and adds: "Call me up by long-distance telephone and give me your answer." The result is that for 15 or 20 dollars a talk is held with the New York man. Having received the telegram he has had an opportunity to concentrate his expressions to the shortest possible statements; he has even jotted them down, and at the proper time calls up his man and transacts his business. So it is done every day.

The railroad president quoted said that in the past he had found it necessary to spend about 20 days of each month on the road, leaving but 10 days of his time at his office. But now, by aid of the long-distance telephone, he has reversed matters; but 10 days are required on the road, giving him 20 days in the office. Half a dozen grain men who had been in the habit of making frequent trips between Chicago and New York said that for three or four dollars they could now transact business which formerly required a three-day trip.

Extensions and Improvements.

It is reported that there are 46 telephone exchanges in Guatemala, Central America, and that the business is improving.

Workmen are engaged in the construction of the new telephone line from Usal, Mendocino County, to Eureka, Humboldt County, Cal.

The directors of the Canadian Bell Telephone company have decided to increase the capital of the company from $3,168,000 to $3,900,000.

T. F. Moore & Co. have secured a contract to construct a telephone line from Amarillo, Texas, to Roswell, New Mexico, a distance of 205 miles.

The telephone company is staking off the new line between Fullerton and Placentia and the town-exchange lines, says the Los Angeles Herald.

The American Telegraph and Telephone company has been incorporated at Little Rock, Ark., to connect Little Rock and Memphis, Tenn., by telephone.

The Southern Bell Telephone and Telegraph company contemplates making extensive improvements to its system at a cost of about $30,000 at Columbus, Ga.

A charter has been granted by the City Council of Live Oak, Fla., to Dr. Boatwright and associates for the erection, equipment and operation of a telephone system.

The Franklin County Telephone and Telegraph company has been organized at Chambersburg, Pa., with a capital of $40,000. A long-distance telephone line will be built.

The Roby (Texas) and Sweetwater telephone system has been purchased by Hughey, Green & McCrea, who will at once extend it to a connection with Abilene and other points.

Clifford H. Strong, Gray Carroll and Thomas S. Busbee are among the incorporators of the American Telegraph and Telephone company, incorporated

at Little Rock, Ark., recently with a capital stock of $10,000.

The Mountain Home and West Plains Telephone company has been incorporated with a capital stock of $5,000 to construct a telephone system from Mountain Home to West Plains, Mo.

The Monmouth (Maine) Telephone company has been incorporated to operate telephone lines. The capital stock is $10,000. The officers are president, J. H. Gilman, an treasurer, H. M. Blake.

The City Council of St. Thomas, Ont., has granted a charter to the People's Telephone company, capital, $60,000, to construct a telephone system in that city. The president is Joseph Mickleborough.

Work of construction has been commenced on the new telephone line in Gila Valley. In addition to connecting the towns in the Gila Valley, the company will build from Solomonville, Arizona, to Clifton.

J. D. Kelly, a lineman employed by the Bell Telephone company at Peterboro, Ont., came into contact with a live electric power-transmission wire and a grounded telephone wire, and was instantly killed.

The Union Suburban Telephone and Telegraph company has been incorporated at Columbus, O., with a capital of $1,000,000. The company will construct telegraph and telephone lines from Sandusky to Painesville, and branch lines throughout the state.

The Central-Liberty Telephone company has been incorporated, with T. N. Hunter president and general manager, and H. L. Clayton secretary and treasurer, for the purpose of constructing a telephone system from Central to Liberty, in Pickens County, S. C.

The Bell Telephone company of London, Ont., has responded to the challenge of the People's Telephone company, and lowered its rates. Telephones in residences have been reduced from $25 and $30 to $20 a year, unlimited, and for doctors and dentists' offices from $35 to $25.

A correspondent of the English publication, Echo, imparts the information to the readers of that journalistic wonder that the telephone will produce more insanity than anything else that was ever invented, "from the small doses of electricity continually shot into the brains of those who use it."

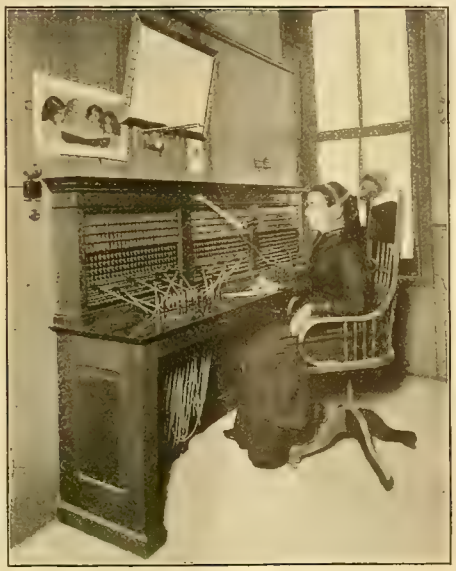
It is suggested that if a small piece of paper be placed between the hammer and the bell of a telephone call it will be held there if the bell is not rung, but will drop out if it is, and that a person who has been absent from his office can in this way tell whether the bell has been rung during his absence.

J. W. Hill, president, and H. E. Teachout, secretary of the Mutual Telephone company of Des Moines, placed an order with the Sterling Electric campany of Chicago recently for a 2,000-drop metallic circuit board. The managers of the Plymouth Telephone company have contracted with the Sterling company to replace the old apparatus with two sections of standard metallic board of the Bell type.

Private branch telephone exchanges are now in use by 18 different railroads in the United States, and the officers of the American Telephone and Telegraph company state that negotiations are pending with several other companies. The railroad using and managing the exchange employs the operators, but the care and maintenance of the wires and apparatus are in the hands of the telephone company, from which the property and rights are leased. In all of these exchanges every instrument is suitable for long-distance communication and every one is connected by a metallic circuit. The number of exchanges established on these 18 railroads is 31, of which 14 are in Chicago, three on the Chicago, Burlington and Quincy; two on the Chicago, Rock Island and Pacific, and one each on other prominent roads. The Pennsylvania railroad has leased wires for telephone connection between New York and Pittsburg. There are exchanges at New York, Jersey City, Philadelphia, Washington, Harrisburg, Altoona and Pittsburg.

The farmers of Allegan County, Michigan, have an exchange of their own, which they maintain by annual assessments, amounting to about $10 each. The line runs from Holland, through Saugatuck, Ganges, Douglass and Fennville to South Haven, and it is used chiefly during the fruit season to facilitate the handling of berries and peaches. About 130 farmers and fruit growers built the line and receive the service. Every township in Oceana County has telephone connections with Hart, the county seat, and this system also is essentially a farmers' exchange, and is owned and maintained chiefly by the farmers and fruit growers. The Oceana County system, like the Allegan County fruit growers' line, is being connected with a state exchange, and now the peach season is fairly open the farmers in both sections will be in easy talking range of the commission and railroad men and the steamboat men at the lake ports. Gratiot County has another farmers' exchange which, with Ithaca as the center, has connections with every township and many farmers. The system gives free service throughout the county to its subscribers, and will soon be connected with the outer world. Farmers living near the cities are having the telephone wires extended out to them, though the movement is still in its infancy. The Citizens' Exchange in Grand Rapids has about a dozen farmers on its list. The first country telephone line was built out a mile west of town. With direct connection with town, the farmer who subscribed for this instrument, could sell his stuff in advance, arrange for his deliveries, and easily keep his finger on market conditions. It gave him an advantage over the other farmers, and it did not take his neighbors long to find it out. The line now runs out about five miles, and all the substantial farmers along the line have hitched on. The farmers north and northeast of the city are clamoring for connection, and in another year they will probably be accommodated. The lettuce growers just south of the city all have connections, but they are so close to the city that they are hardly called farmers.

The Lee County Telephone company has just completed its system by putting in a line from Steward to Lee and from Lee to Pawpaw, which furnishes a complete circuit of Lee County, Ill., and provides against any place on the line being deprived of service. The system includes 14 exchanges at the following-named points: Dixon, Eldena, Amboy, Harmon, Shaw, Sublette, West Brooklyn, Lee Center, Compton, Pawpaw, Lee, Steward, Ashton and Franklin Grove. Toll stations have been established at Grand Detour, Nachusa, Walton, Gap Grove, Prairieville and Flagg, and on the lines between exchanges, making a total of nearly 450 telephones in the county. The company gives subscribers free connection with Rochelle, which has 125 telephones; all of Whiteside County, with over 200 telephones, and charges only a 10-cent cross-country toll with the Tri-city company of Fulton, Lyons and Clinton, Ia., which has over 500 subscribers; also with Chadwick, Carroll



VICTOR TELEPHONE SWITCH-BOARD

County and Mendota, La Salle County. Connection will soon be made with Creston, Malta, DeKalb and Sycamore in DeKalb County.

Victor Telephone Manufacturing Company's Apparatus.

The Victor Telephone Manufacturing company of 166-174 South Clinton street, Chicago, is certainly a factor in the independent field. Since establishing itself, within the last six weeks, it has secured some fine orders for both telephones and switchboards. If what the company has done in this short time is any criterion, it will only be a question of a few months before its apparatus will be installed largely throughout the United States.

The illustration shows a 300-number switchboard installed by the Victor company in the plant of the Cicero Telephone company of Austin, near Chicago. This fine plant has grown from 80 subscribers to 300, who are given a rapid and efficient service in competition with the Bell company. The switchboard shown, while not the five-jack and drop type, the latest Victor pattern, is reliable. The Victor people take especial pride in this plant, as the board shown has displaced another make and was selected by the experts of the Cicero company after a thorough inspection of the other boards manufactured in the independent field.

The new self-contained, invisibly wired five-jack and drop switchboard of the Victor company is now in the course of construction, and within 60 days there will be a large number of plants equipped with this board, as the Victor people have orders on their books for the equipment of several plants with boards ranging in sizes of 100 to 500 drops. This company takes special pride in the workmanship, material and character of the finish of its apparatus, the production of which is under the direct supervision of skillful telephone engineers. Some of the claims made by the Victor company for this board are economy of maintenance, simplicity of construction, ease and rapidity of operation; also the ease with which one can obtain access to any part of the board for any needed repairs of adjustment of construction. So simple is this board in construction that it will require practically no attention.

The company's plant is fully equipped with the latest machinery for the manufacturing of central-station supplies and telephone apparatus. The company prides itself in the skilled labor which it employs, having no child labor in its factory; the result of this policy is first-class work at all times.

The long-distance telephones manufactured by this company are all equipped with long-distance arm transmitters and double-pole receivers. The mouthpieces, receiver cases and the like are made of hard rubber and not fiber, as is often the case.

The company extends a cordial invitation to prospective buyers to inquire about any apparatus they may want and to visit the plant for the personal inspection of the Victor products.

The Telephone in the Klondike.

Several months ago the Western Electrician announced the establishment of telephonic communication in the Klondike. The gold seekers appreciated the service and the system has been considerably extended since then. The Yukon Midnight Sun of July 11th contains the following note: "E. I. Jensen, manager of the Yukon Pioneer Telephone company, reports the line finished from the centrals in Dawson and Klondike City to the Forks. This is quick work and will fill a much needed want in the community. The centrals are located at the Dominion saloon, Dawson, and at Tom O'Brien's store in Klondike City." The Sun is a weekly of 12 small pages, and the subscription price is $15 a year, $8 for six months, $5 for three months, or 50 cents a single copy, "invariably in advance." If the telephone rates are proportionately high the service must prove profitable.

COMMUNICATION.

Installation of Lightning Arresters.

To the Editor of the Western Electrician:

Allow me to say a few words relative to the installation of lightning arresters. I have had considerable experience with this class of work, and I have noticed several improper methods, which may be avoided without difficulty.

For one thing, it is always well to follow the directions given by the manufacturer. All electric-railway and light companies employ men classed as linemen or electricians, who are entrusted with the installation of the various instruments or devices which are purchased for their plants. It is often the case that these men trust to their own judgment rather than to the judgment of the manufacturer and install the apparatus in accordance with their own ideas. This is a mistake. It is not that these men are not well versed in their business; they are often in possession of valuable information gleaned from their own practical experience; but it is always better to carry out the instructions of the manufacturer and to let him shoulder the blame if the operation of machines or instruments is not satisfactory. I have found many such cases to explain the reason for the failure of lightning arresters to protect plants, transformers, etc.

Lightning-arrester lead wires should never be curled or twisted around span wires or tied into knots to take up the slack. If the wire is too long it should be cut to the proper lengths and made as straight as possible.

To test lightning-arrester grounds, especially on railway circuits, a bank of five lamps should be carried, and if, when the terminals of the lamp circuit are connected with the line and the ground terminals of the lightning arresters, the lamps come to candle power, the ground may be considered as satisfactory. Otherwise it should be improved.

As a matter of mechanical protection, gas-pipes have been used to cover the ground wire, and in hundreds of instances have rendered the lightning arrester useless, as the iron pipe around the wire acts as a choke to the discharge. Wherever ground wires are run to the ground through pipes, they should be connected to the pipe through which they run. This applies to any wire in a lightning-arrester circuit. Where installations have been made in this way I have often advised removing the installation from the wire at the top of the pipe and driving a wooden wedge into the pipe to force the wire against the pipe, to keep it in that position. The ground wire should never be alive, and therefore there is no danger from having the wire connected with the pipe. Lightning arresters which were unsatisfactory with the wire run through the pipe have proven very satisfactory after making the change suggested here. W. R. GARTON.

Chicago, August 30, 1898.

A scheme is on foot to extend the electric road of Santa Cruz, Cal., to the bitumen mines and to purchase the East Santa Cruz Street railroad and to convert it into an electric road and extend it to Soquel and Capitola.

Portable Electric Pump.

While the combination herewith illustrated was especially designed to be used in the California Winery of Sacramento, Cal., it may be applied to other purposes. The outfit consists of a Westinghouse Electric and Manufacturing company's type "C" alternating current induction motor of two horse power capacity direct-connected to a centrifugal pump. The machines are mounted upon a suitable truck by which they are transferred from place to place in the operation of pumping wine from one vat to another. Receptacles for electrical connections are provided at convenient points throughout the winery, and the motor is connected by means of flexible cable to the circuit of the Central California Electric company, whose power is generated at New Castle, 30 miles from Sacramento.

The motor has neither commutator nor brushes, and there is no connection between the revolving part and the electric circuit. Beyond the occasional oiling of the bearings, no further attention is required over long periods of operation, and it may be handled by the most inexperienced persons with perfect safety.

The centrifugal pump is peculiarly adapted to handle liquids of whatever nature. It is capable of pumping under the most difficult conditions, and will handle hot or cold liquids successfully, even though they contain from 20 to 40 per cent. of solids. Thus it will be seen that the applicability of the device extends beyond the luxuries of life, as in the pumping of wine, beer or other spirits, to the more arduous duty of pumping the dirty and muddy accumulations in electric-subway manholes, tannery liquids, dyes, bleaching solutions, vinegar and brine liquids used in pickling, and, in fact, is applicable to a multitude of services in the arts and manufactures, in which it is destined to be a permanent economic feature.

General Electric 160 Horse Power Motor.

For elevated and underground railroads as well as suburban and interurban railways the General Electric company has recently developed the "G E 55" motor, herewith illustrated. The new motor, while differing but slightly in outward appearance from previous "G E" motors of similar capacity, embodies many important improvements, which, it is claimed, render it the only suitable motor for this class of work. It has been tested on the New York, New Haven and Hartford railroad, the Metropolitan and Lake Street elevated roads in Chicago, and on the locomotives of the Buffalo and Lockport railway, under actual steam-road conditions, and it is asserted that it has proved by its success the suitability of its design and the excellence of its construction.

The magnet frame is of soft steel, cast in one piece in the form of a cube with well-rounded corners. In each end is a bored-out opening large enough to allow of the removal of the armature pole-pieces and field coils. Into this opening fits a frame head held in place by four bolts and carrying the armature-shaft bearing. The axle-bearing caps are bolted to vertically planed surfaces on the frame. The four pole-pieces are built up of soft iron laminæ and are bolted to the top, bottom and sides of the frame, with the nuts on the outside. The frame has a large opening above the commutator, through which it and the brushes may be inspected and the worn-out brushes renewed. The brush holders and insulating supports may also be removed through this opening, which is protected by an easily removable iron cover, securely clamped down by an adjustable cam-locking device. In the bottom of the frame, directly under the commutator, is a large hand-hole, protected also by a cover.

The four field coils are wound on metal spools held in place by laminated pole-pieces. The winding is of strip copper of ample cross-section, thoroughly insulated from the spool, and each winding is tested at the works to a potential of 5,000 volts.

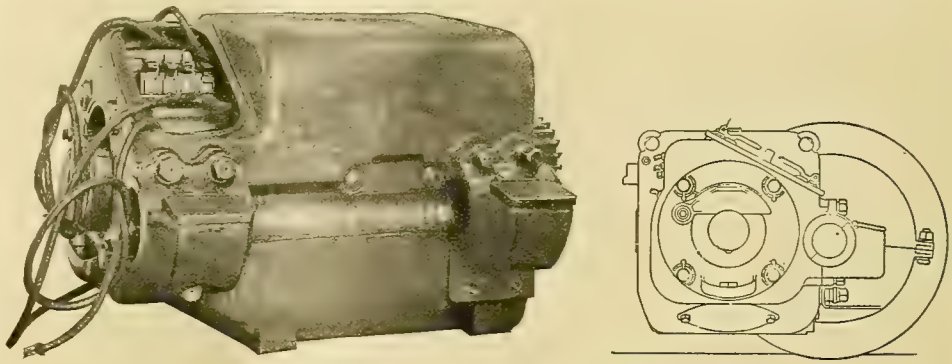
The aramture is of the iron-clad type, with a core built up of soft iron laminæ, insulated from each other by coats of japan and assembled on a composition metal spider securely keyed to the shaft. The slots are so uniformly punched in the sheets that the assembled core has smooth and regular slots in which to place the conductors. The winding is of the series drum-barrel type, and is made up of stranded copper conductors thoroughly formed and insulated before insertion in the slots of the core. The insulation placed on these coils is of the highest quality obtainable, and is practically impervious to moisture. The conductors are soldered directly into the ears, which form part of the commutator segments, avoiding the use of connecting leads. Before assembling on the motor, the armature is tested to withstand a potential of 3,500 volts between the commutator and the core. To prevent carbon dust from finding access to the end windings the latter are thoroughly covered with stout canvas bound in place.

The commutator segments, of hard-drawn copper, are built up and securely clamped on a malleable-iron shell, the best quality of mica being used for the insulation.

The cone-clamping insulations are of the same high-grade mica built up and pressed hard into compact shape, but the mica between the segments is of a somewhat softer quality to allow of even wearing with the segments. Each commutator is subjected to a high-potential test of 5,000 volts between segments and shell, and 500 volts between adjacent segments. Under all normal conditions it will run without injurious sparking.

The bearings of the armature are supported in the frame heads, which extend inside the armature and commutator. They are lubricated by oil and waste, put in place through a hand-hole, as with the ordinary car-box bearing. The brasses take the form of a sleeve, with the sides cut away to expose the shaft to the oily waste. The use of oil makes it easier to keep the motor clean, and oil deflectors are provided to prevent any access of the lubricant to the inside of the machine. Drip cups, cast into the frame heads under the armature bearings, allow of the removal of used oil. The commutator end bearing is 3¼ inches in diameter and 7½ inches long, and the pinion end bearing 3¾ inches in diameter and 11 inches long. A similar system of lubrication is employed with the axle bearings, which measure 5¼ inches in diameter and 10½ inches long, as with the armature-shaft bearings.

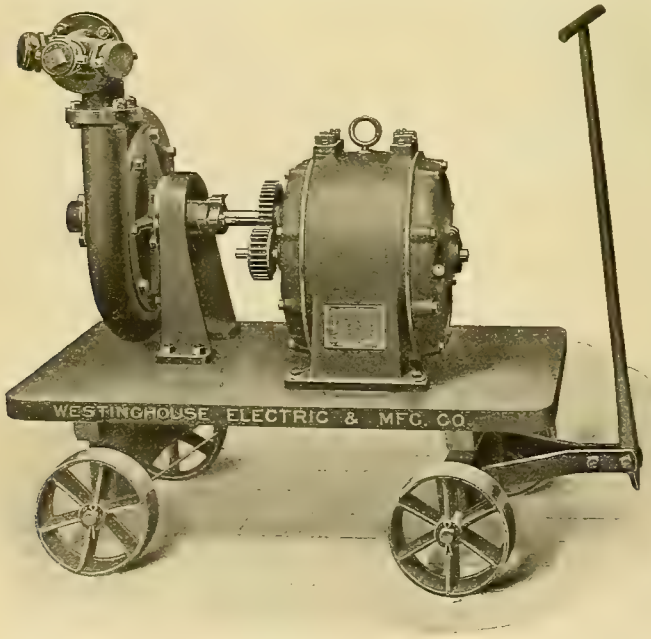
All the leads are brought out through rubber-bushed holes in the magnet frame and are easily removable. The two brush-holders are of cast-brass, each carrying four carbon brushes which slide in finished ways and are pressed against the commutator by independent fingers, giving a practically uniform pressure throughout the working range of the brushes. The holders are bolted to guides, which in turn are clamped to a specially designed mica-insulated stud. The "G E 55" motor is rated at 160 horse power. It weighs approximately 5,000 pounds.



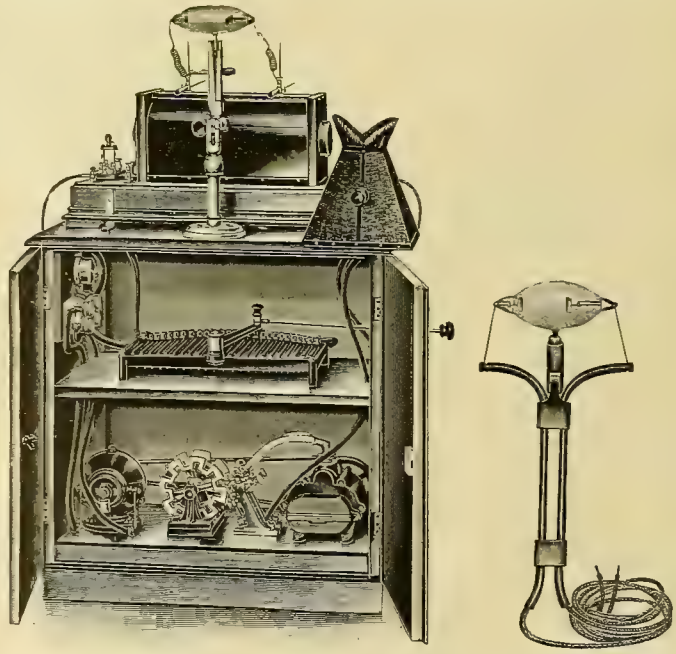
GENERAL ELECTRIC 160 HORSE POWER MOTOR.

X-ray Apparatus on a Hospital Ship.

At the beginning of the Santiago campaign the necessity of equipping the hospital ships with efficient and powerful X-ray apparatus was immediately perceived by the surgeon-general of the United States navy, who realized the importance of installing apparatus which should be powerful and also so simple in construction and operation that it could be properly handled by any ordinary mechanic. An order was placed with the Edison Manufacturing company for one of its latest portable cabinet X-ray outfits, to be placed on board the U. S. Naval Hospital ship Solace, and the entire apparatus was placed in position ready for use within 48 hours after the placing of the order. A brief description of this apparatus, which is illustrated herewith, will be of interest.



PORTABLE ELECTRIC PUMP.



FIGS. 1 AND 2. X-RAY APPARATUS ON A HOSPITAL SHIP.

The cabinet, which is made of polished quartered oak, occupies a floor space of two feet eight inches by one foot eight inches, and is furnished with four wrought-iron L's screwed onto the base, by which it can be rigidly fastened to the deck. This is most necessary, as, in case of heavy weather, the apparatus might be damaged by the ship rolling if it were not firmly attached in this way.

The Edison coil, which is mounted on top of the cabinet, is also furnished with brass L's and strips to hold it firmly in position, and the base of the adjustable focus-tube stand is similarly screwed to the top of the cabinet. The upright part of the focus-tube stand has a wooden screw, by which it is attached to the base, and when the focus-tube stand is not required to be used, it is only neces-

sary to unscrew the upright from the base, which can be done in a moment.

The distinctive feature of the Edison electric-light X-ray outfits is that there is no vibrator on the induction coil, its place being taken by the instantaneous air-break wheel device shown in the bottom part of the cabinet.

This device consists of two tooth-wheels mounted on the same shaft. The projections or teeth make contact with two flat brushes which bear on the outer peripheries, and by which the current is brought in and led out again. These wheels are rotated at a very high speed, by a small direct-current motor, which also runs a pressure blower. The air blast from this blower enters a bifurcated tube and is conducted to two flat nozzles immediately over the contact brushes.

When the device is set in operation, by starting the motor and connecting the primary of the Edison X-ray coil in series with the binding-posts (attached to the break-wheel) provided for this purpose, the spark formed at the contact brushes, when the coil is energized, is instantaneously blown out by the air blast at the moment of formation. This greatly increases the rapidity of change in the magnetic circuit, and consequently augments the electromotive force in the secondary coil.

The controlling rheostat shown on the upper shelf of the cabinet is used to vary the current in the primary of the Edison coil, and the lever arm of the rheostat is connected to the extension rod passing through the side of the cabinet, so that the doors of the cabinet can be closed and the rheostat actuated by means of this extension rod, which is shown on the left-hand side of the cut (Fig. 1). The main switch is shown on the left-hand side of the cabinet, near the top, and the cut-outs directly underneath. The advantage of this arrangement is that as the keys of the cabinet are always in the possession of the chief surgeon on board ship, it is impossible for anyone to use the apparatus without his permission.

The coil is protected by a polished oak cover (not shown in the cut), which fits over the top of the cabinet, and in which, room is left for the fluoroscope to fit into, so that the apparatus is entirely protected when not in use. The operation of the apparatus is exceedingly simple. The focus tube is clamped in the jaws of the focus-tube stand and connected to the secondary binding-posts of the Edison coil by two highly insulated thin wires.

The doors of the cabinet are now opened and the main switch is turned, which starts the motor and the pressure blower in operation. The doors of the cabinet are then shut, in order to economize space, and the reversing switch, shown on the left of the coil (Fig. 1), is closed, so that the secondary current from the coil excites the focus tube, and the energy of the coil is increased by gradually drawing out the extension rod attached to the lever of the controlling rheostat.

The patient is now placed in front of the focus tube and the fluoroscope placed behind the limb or that portion of the trunk that it is desired to examine.

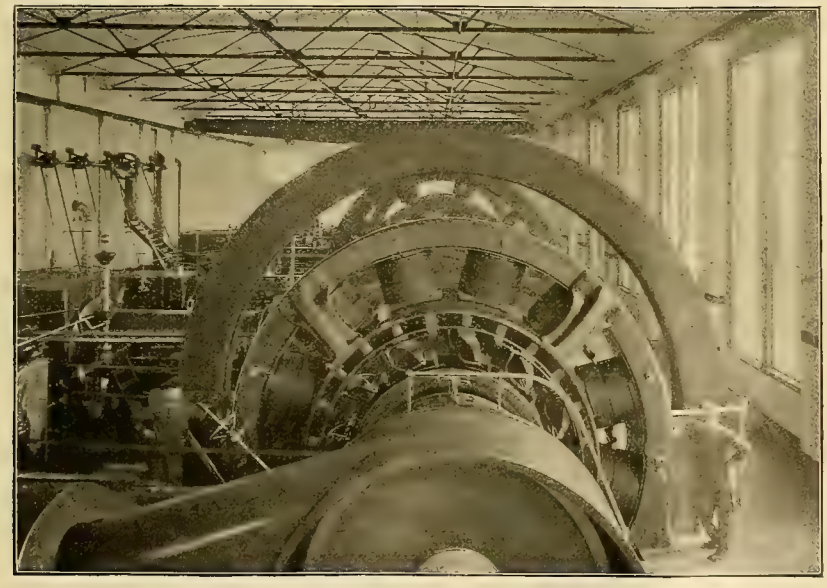


FIG. 2. RAILWAY POWER STATIONS IN BOSTON.

In cases where the patient is so seriously wounded that it is necessary for him to maintain a reclining position, the focus tube is attached to the portable focus-tube holder (shown in Fig. 2), and the focus-tube stand is dispensed with. The end of the portable tube-holder wires, which are very highly insulated, are now attached to the secondary binding-posts of the coil. These heavily insulated connecting wires are several feet in length and the portable focus-tube holder is made of hard rubber, so that it can be handled easily without fear of shock to the operator.

The portable focus-tube holder, with focus tube, is now placed underneath the cot or operating table, and the surgeon makes his examination by looking through the patient from above.

The entire apparatus is substantially and strongly made, and is also of handsome design, and the work that has already been done with it has shown the great value of such an apparatus in warfare. One great advantage possessed by this apparatus is that it may be moved from place to place with but little delay, as the cabinet is mounted on heavy casters, and it is only necessary, when it is not fastened purposely to the floor or deck, to disconnect the attachment plug and cord attached to the main switch from the receptacle into which it may be screwed, and the cabinet may then be moved to any part of the ship or hospital and attached to another receptacle by screwing in the attachment plug.

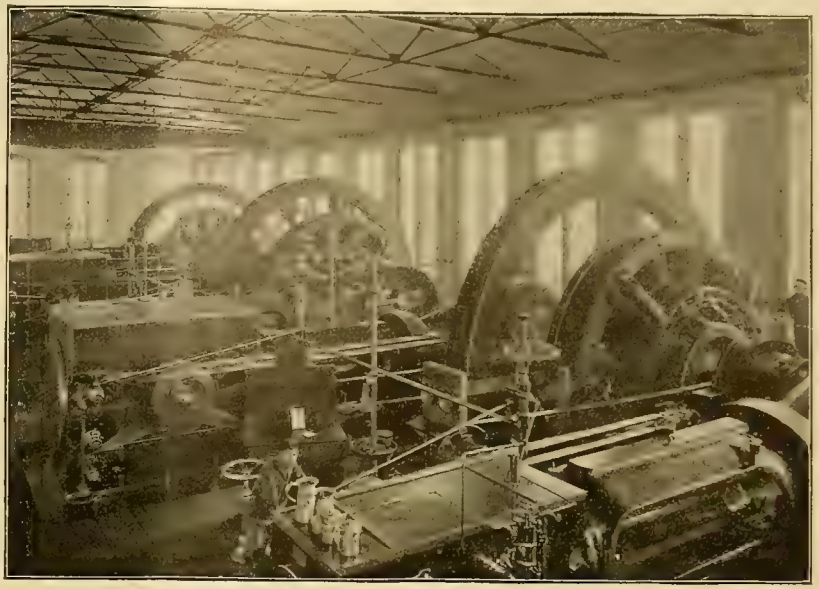


FIG. 1. RAILWAY POWER STATIONS IN BOSTON.

Some Suggestions Relative to Determining the Cost of Electric Supply.

[*Continued from page 144.*]

basis of charging full rate for a certain use of the installation, say an hour a day, for each day in the month of 30 days. Say a man had used 90 kilowatts, as shown by the meter at the end of the month, you would charge him on 30 kilowatts at your best rate and on the other 60 kilowatts at a less rate, according to a graded system of reduction. The Wright system of charging does not necessarily mean two rates. It means simply that a man gets a rate based on the hours of use he makes of his demand on the station. You need not apply it through the two-rate method; you can apply it through any curve you like. If he uses the current, say one hour, at the one-hour rate; say two hours, 50 per cent. off, and the third hour grading down; but the difficulty is, you would be charging him a varying rate each month according to the hours' use he made, whereas under any two-rate system you get your varying rate out of whatever hours' use he makes of it.

Mr. Holmes: The maximum use has much to do with the charge?

Mr. Scovil: Yes, sir; and you have to take your maximum use in the winter time as the demand on which you have to charge for the year. In Brighton they don't do that. They make it such a charge sufficiently high so as to cover the lower use of it in the summer time. That is to say, they take the demand on the six months' period in the summer time, and charge on that maximum, and the six months' winter period, and charge on that maximum, for the first hour's rate. We have different ways of getting at it. In case we know the connected load is the maximum, we take the connected load. Where we know it is not the maximum, we get a demand meter, which is nothing but an instrument which shows a certain amount of current has passed through, with a fluid which rises to the highest point of use and leaves a record there.

I have found these demand meters serve a good turn in another respect. When people come in talking about discrimination I show them the record on the instrument, and say to them, "There is the the way that man uses his current. You use it the same way, and I will give you the same rate." There is no secret about it.

Mr. Holmes: Does that operate to reduce the bill to larger consumers?

Mr. Scovil: Not very much; because we take care in adjusting the initial rates to regulate that. We have also succeeded in encouraging a certain number of customers to whom the commercial discount would not apply. We have quite a number of people who don't have bills of more than $6 to $8 and $10 a month; yet they are entitled to the biggest discount we make, and they get it now under this system. We had no way to get at it before, except to make it arbitrarily, and then have somebody telling what good rates they are getting from the electric light company, and the neighbors all coming in and wanting the same thing.

Mr. Schmidt: Do you in that have reference to the customers that use few lamps and use them for a long number of hours each day? They are really the ones that are entitled to the greatest discount, because they are making the most steady use, tending to an even consumption.

Mr. Scovil: Yes, sir.

Railway Power Stations in Boston.

Managers of large street-railway properties who attended the Boston convention of the American Street Railway association found much to study and admire in the equipment of the local system of electric street railways. Boston was the first important city of the country to introduce the overhead trolley on a large scale, and, as might be expected, much of the early work was of an experimental character. While the experience gained in the development of the system was of great value, it was also expensive, as the pioner equipments had to be replaced by machinery of modern design and construction. To-day there is little to be found in the power houses of the old West End system that had a place in the early work of the company.

An excellent illustration of present-day practice is found in the equipment of the Cambridge station. In the accompanying illustrations Fig. 1 shows three G. E. direct-connected railway generators of 1,200 kilowatts capacity, operated at 80 revolutions per minute. These generators are 12-pole machines. Fig. 2 is a near-by view of the same equipment. They have been adopted as a standard for work of this kind by the Boston company.

Another equally interesting illustration of the development of the modern power plant is to be found in the Albany street station of the West End company. In the early 90's the direct-connected dynamo was almost unknown, and this station, one of the largest and best appointed of its time, was put up with counter shafting. The engines were arranged on each side of the building, and the

center was divided into two stories, the lower part being utilized by shafting and the upper containing the dynamos. Six triple-expansion Reynolds-Corliss engines were installed, having belt wheels 28 feet in diameter and 10 feet 7 inches in width, for two belts, each five feet in width. These belts ran to eight-foot pulleys upon the countershafts, and the counters were belted to the dynamos, both the engine and dynamo belts being provided with tighteners. With the development of the direct-connected machine, it became evident that an increase in the power of the station could be effected more cheaply and efficiently by doing away with the intermediate shafting, and employing the more compact direct-connected unit in the existing building rather than by extending the station upon the original lines. The massive cast-iron belt wheels of the triple-expansion engines were replaced with flywheels of plate steel, leaving room on the same length of shaft for the armature of the generator. The dynamo floor was entirely dismantled, and the entire floor finished off upon the engine level, and two compound engines placed in the central row where the dynamos had been. The same type of generator as that installed in the Cambridge station was adopted for the Albany street plant. In transforming the latter station into its present modern and efficient form it was found necessary to change the general layout of the plant, dismantle the elevated dynamo floor, discard the older type of generators and all the countershafting and transmission machinery after a service of only five years, and remodel the engines for the direct-connected generators, involving a large expenditure of money, which, however, is offset by better economy in labor and efficiency, and the additional circumstance that the company is thus enabled to increase the capacity of the station about 100 per cent. As now constituted the station is well organized, compact and efficient—a tribute to the enterprise of a management which did not hesitate to keep up with the developments, even at such an apparent sacrifice, and a striking instance of the progress that has been made in the development of the modern electric power plant for street-railway service.

Dr. John Hopkinson.

No further details of the tragic death of Dr. Hopkinson, with his son and two daugters, in the Alps, beyond those given in the Western Electrician last week, are at hand. But it is fitting to present to the readers of this journal a portrait of this distinguished engineer and a more detailed sketch of his career than could be used in the space available in the issue of last week when the news of the accident was received. The portrait is a reproduction of a steel engraving issued by the Electrician, and the sketch is based on an article in the Electrical Engineer of London.

John Hopkinson, D. Sc., F. R. S., was born in Manchester in 1849. His education commenced at Lindew Grove School and was afterwards carried on at Queenswood College, but he left there at the early age of 15 to enter Owens College, Manchester, where he remained until he was 18, when he entered Trinity College, Cambridge. In the year 1870 he graduated as doctor of science in two branches in the University of London, taking as his subjects "Pure and Applied Mathematics" and "Light, Sound and Heat," under the original regulations for that degree. In the following year he graduated at Cambridge as senior wrangler and first Smith's prizeman. These two honors are rarely obtained by one man, as the Smith's prize examination is essentially a test of mathematical creative power or capacity for original work, while the mathematical tripos has always been rather to test a man's capacity of assimilating and reproducing with accuracy and rapidity the work of others. By obtaining the first place in both examinations, Dr. Hopkinson therefore showed that both his receptive and creative mathematical powers were of a high order. While at Cambridge Dr. Hopkinson was known as a good oarsman and runner, and he won a footrace only three weeks before the commencement of his tripos.

Early in the year 1872 Dr. Hopkinson accepted the appointment of engineer to Chance Bros. & Co.'s lighthouse works, near Birmingham, where he lived until 1878, when he moved to London, and began practice as an engineer on his own account, without, however, giving up his connection with the firm. To Dr. Hopkinson are due many improvements in lighthouse work, notably the group-flashing apparatus. After his removal to London he soon became widely known as an expert in patent cases, and this work always formed an important branch of his practice. In addition to acting as consulting engineer to the Metropolitan Electric Light company and several other companies, Dr. Hopkinson contributed many able papers to the Royal Society and other scientific bodies.

During the years 1879 and 1880 Dr. Hopkinson read two papers of exceptional importance on "Electric Lighting" before the Institution of Mechanical Engineers. In the first of these he described a number of experiments made with a Siemens dynamo to determine its efficiency under varying conditions, and mapped out the relations between electromotive force and current by means of curves, since called "characteristic curves" by M. Marcel Deprez. In the second paper a number of somewhat similar experiments subsequently made by other observers on Siemens and Gramme dynamos were mapped out in the same way. It also contained descriptions of a method of measuring the brightness of the electric arc and the determination of the ratio of the potential difference at the ends of the carbons to the current passing. Early in the year 1883 Dr. Hopkinson made some improvements in the Edison dynamo, which proved to be of exceptional importance as forming the basis of subsequent important improvements in dynamo machinery. In the same year he was appointed to deliver before the Institution of Civil Engineers one of a series of lectures on "The Practical Applications of Electricity." His lecture was entitled "Some Points in Electric Lighting," and in addition to a general exposition of the subject, he developed in it some very important points, such as the possibility of running two or more alternating machines in parallel and the relations between the efficiency and the dimensions of a dynamo, and he also pointed out that the fact, previously observed by Mr. Shoolbred in experimenting with a series-wound Gramme machine, that after a certain current strength had been obtained the electromotive force began to diminish, could be explained by the approach to magnetic saturation of the iron of the machine.

The theory of alternating dynamos was further developed in a paper on "The Theory of Alternating Currents," read before the Society of Telegraph Engineers in 1884. In 1885 and 1889 Dr. Hopkinson read two important experimental papers before the Royal Society "On the Magnetization of Iron" and "On the Magnetic and Other Physical Properties of Iron at a High Temperature." Early in 1880 he

DR. JOHN HOPKINSON.

discovered peculiar properties of an alloy in nickel and iron. In 1886 he read a notable paper before the Royal Society "On Dynamo-electric Machinery." This paper contained an account of investigations carried out in conjunction with his brother, Dr. E. Hopkinson, with the object of obtaining an approximately complete construction of the characteristic curve of a dynamo of given form from the ordinary laws of magnetism and the known properties of iron, and to compare the results with the actual characteristic of the machine. Another important paper "On the Electrical Illumination of Lighthouses" was read before the Institution of Civil Engineers in 1886.

Dr. Hopkinson was elected a fellow of the Royal Society in 1878, and he was a member of the Senate of the London University. In 1890 the Royal Society awarded to him one of the royal medals, and during 1890 he was the president of the Institution of Electrical Engineers. He was again elected president of the Institution of Electrical Engineers in 1895. He was a member of the council of the Institution of Civil Engineers and of the council of the Institute of Mechanical Engineers. He designed and superintended important electric-lighting and railway plants in London, Manchester, Whitehaven, Stafford, Leeds and Liverpool.

Pacific Cable Projects.

At a meeting of the directors of the Pacific Cable company in the office of J. P. Morgan & Co. in New York on September 1st, plans were considered for establishing cable communication with the Philippines, the Asiatic coast, Japan and Australia, via Hawaii. Surveys for a duplicate cable by way of Sitka and the Aleutian Islands were ordered. James A. Scrymser, president of the Pacific Cable company, will sail from Vancouver for Japan on September 12th.

From Wellington, New Zealand, comes the news that the report of the committee of the Legislature, just issued, recommends joining the Australian colonies with Canada and the mother country by a Pacific cable, on the basis that if Great Britain and Canada together would guarantee five-ninths of the cost of the work, New Zealand and the other colonies would contribute the remaining four-ninths, of which New Zealand will contribute one-ninth. The committee also recommends that Canada be intrusted with the construction, administration and maintenance of the cable, on the understanding that the contributing colonies are to be entitled to representation and votes on matters of policy of the management, and that the cable is to be jointly owned and controlled by the contributors. The report concludes with advising that a conference of the colonies concerned in the new cable be held in New Zealand.

Lightning in New England.

[Special correspondence of the Western Electrican.]

Concord, N. H., September 4.—The festive lightning continues its mad pranks with unusual vigor and unique accompaniments this season. During a shower last week a bolt struck the chimney of a house in Northfield, shattering the top. It continued down the funnel to a cook stove in the kitchen where were seated several persons. It there divided, one bolt going down the leg, tearing up several boards and thence into the cellar. Another bolt, or part of the original bolt, took another leg of the stove as a pathway to the floor, and then went across the room, striking a table of house plants with disastrous effects. Still another bolt entered a closet, exploded a box of cartridges and threw the door off the hinges. The remainder of the discharge developed more of an exploring disposition. It entered the room back of the stove, piercing the wall like a 48-caliber rifle bullet, and passing through the center of a picture on the wall. It then circled around the top of the room, leaving a track like a smoky torch. Having completed the circle it shot downward to a bed, cracked the headboard, shattered both rails and knocked a piece out of the footboard. It is needless to say that these antics created some commotion, but no one was injured and the owner says that $10 will cover the actual damage to the property.

The same storm was accompanied by an exceedingly high wind and caused considerable trouble with aerial wires in this city, crippling the street-car and electric-light and telephone service in three or four places. A. B. C.

Carbon Tariff Controversy Still Unsettled.

[From the Washington correspondent of the Western Electrician.]

On the 12th of August last a decision was rendered by the United States Board of General Appraisers [reported in the Western Electrician of August 27th], wherein it was held that sticks or rods of carbon in lengths of 36, 24 and 29 inches were dutiable at 35 per cent. ad valorem under the provision of paragraph 97, of the tariff act of July 24, 1897, as "articles * * * composed or carbon." That decision maintained that the action of the appraiser or collector in assessing duty thereon upon the theory that each rod may be divided into shorter lengths or a number of smaller rods suitable for electric lighting was without authority of law. In accordance with the first decision the merchandise in question was classified as "carbons for electric lighting," and as such assessed at the rate of 90 cents per hundred under paragraph 98 of that act, allowing 12 inches as the commercial length of each carbon, in accordance with instructions issued by the Treasury Department on October 28, 1897.

Assistant Secretary of the Treasury Howell has now written to the collector of customs at New York notifying him that the department does not concur in the decision of the Board of General Appraisers, as stated above, and he has been directed to file an application for review as provided under section 15 of the customs administrative act of June 10, 1890.

Telegraphs in Porto Rico.

Advices from the Signal Service men in Porto Rico to the War Department at Washington show that there are 300 of these troops now there and that they will have to assume the control and operation of the government lines of telegraph. The lines now, of course, are operated by the Spaniards, but when the possession of the island is transferred to the United States the Signal Service will have to take charge until the future status of the system is determined.

This government always has been opposed to a governmental telegraph system, and Signal Service officials say it is not improbable that the lines in the new island possession will be eventually sold to private enterprise through bids for its purchase. This, however, has not yet been taken up officially, and government control will have to be assumed, at least until the ultimate disposition is determined, at all the offices on the entire telegraph system of Porto Rico.

Blue-print diagrams of the system have been forwarded to Washington to the Signal Service authorities. They show that, aside from a line that runs irregularly along the coast, there are two lines running directly north and south, and others forming a network through the island. The principal

telegraph stations which the Signal Service will have to man are at San Juan, from which there is a double line to Caguas; Ponce, from which there is also a double line to the shore; Mayaguez, Yauco, Guayama, Arroyo, Humacao, Fajardo, Aguadilla, Arecibo, Utuardo, Rio Piedras, Cayey, Aibonita and Ciates.

Justice for the Military Telegraphers.

At this week's national encampment of the Grand Army of the Republic in Cincinnati there is little doubt that the last remaining act of justice to the military telegraphers of the Civil War will be performed. The following preamble and resolution, adopted by the department of the state of New York, explain the matter:

Whereas, Congress, after a long period of delay, has at last rightfully recognized the members of the United States Military Telegraph Corps who served in the army during the War of the Rebellion as an integral part of that army, and by act approved January 26, 1897, fixed its status as a corps of the United States Army; and,

Whereas, The Grand Army of the Republic, through its national encampment, has declared that the said corps constituted in fact a part of the Union army, partaking largely of its hardships and dangers, while rendering invaluable aid; and,

Whereas, The members of the United States Military Telegraph Corps have made an appeal to the Grand Army of the Republic for admission into its ranks;

Therefore, be it Resolved, That we hereby indorse that appeal and earnestly request the national encampment to grant it.

Standards of Measurement.

Dr Henry S. Carhart of the University of Michigan at Ann Arbor has made the following report as secretary of the committee on "Standards of Measurement" to the American Association for the Advancement of Science, Section B:

"The determination of the mechanical equivalent of heat by the electrical method, as reported by Griffiths (Phil. Trans., A, 1893) and by Schuster and Gannon (Proc. Roy. Soc., November, 1894) gave a larger value than Rowland's corrected result. This fact has created a demand for the redetermination of the ampere in terms of the electro-chemical equivalent of silver. At the Toronto meeting of the British Association last year a grant was made to the British Association committee on electrical measurements for the purpose of carrying out this investigation.

"At the Detroit meeting of this association the grant of $50 previously made for the use of this committee was made available for the past year. Though this appropriation was clearly insufficient for the purpose, it was decided that the redetermination of the ampere should be undertaken for the committee of this association in the physical laboratory at Ann Arbor. The work has been ably carried to completion by Professor Patterson and Dr. Guthe. The details of the method will be given in a paper by Dr. Guthe before Section B.

"The discrepancy between Griffiths' results and those of Rowland is about one part in 400 at all temperatures between 15° and 25° on the nitrogen scale. Those of Schuster and Gannon exceed Rowland's at 19.1° on the same scale by about one part in 500 (Johns Hopkins University circulars, June, 1898). These differences exist after the final elaborate comparison of thermometers and the reductions to the same absolute scale of temperature.

"Since the electrical methods employed to determine the mechanical equivalent of heat involve either the current and the electromotive force of the Clark cell or the square of this electromotive force, and since the electromotive force of the Clark cell is determined by means of the silver voltameter, it is evident that the current enters the final result as the square. If the discrepancy is due entirely to an error in the value of the ampere, assuming the ohm to be correct, then the ampere should be one part in 1,000 to one part in 800 larger than the present accepted value. That is, the electro-chemical equivalent of silver should be increased from Lord Rayleigh's value of 0.001118 to 0.0011191 or 0.0011194. Lord Rayleigh does not claim for his result an accuracy greater than one part in 1,000.

"The method used by Patterson and Guthe was that of a specially constructed electro-dynamometer of large dimensions, and the employment of the torque of a phosphor-bronze wire to equilibrate the counter-torque due to the effort between the magnetic fields of the stationary and movable coils. This method eliminates entirely the value of gravity g. The torque of the wire was measured by observing the period of vibration of a cylindrical brass weight of known mass and dimensions when suspended by the phosphor-bronze wire. The entire success of this part of the investigation was due to the fact that the observations were made with the whole apparatus enclosed in a fairly good vacuum. Under these conditions the vibrations could be followed for hours at various intervals; the logarithmic decrement was almost entirely constant, and it was easy to obtain a curve connecting temperatures and periods of vibration as a torsional pendulum. The wire was so connected to the support and to the brass cylinder that it could be transferred from the vacuum apparatus to the electro-dynamometer and back again without disconnecting it from the terminal pins. From personal inspection at the several stages of the investigation assurance can be given that the work has been most carefully executed at every point, and all known sources of error have been as completely eliminated as possible. The weights employed were compared with the standards at the United States Bureau of Weights and Measures in Washington; the standard of length was a half-meter bar of speculum metal made for the University of Michigan by the late Professor W. A. Rogers. The time was taken from a standard Riefler clock checked by comparison with the observatory time. The result of the investigation is that the electro-chemical equivalent of a used solution of neutral silver nitrate, 15 parts by weight of the silver salt to 85 parts of distilled water, is 0.0011192 gm. per ampere per sec. This exceeds Lord Rayleigh's value by about one-ninth of one per cent. and causes the discrepancy in the mechanical equivalent of heat to disappear.

"The corresponding change in the electromotive force of the Clark cell will be from 1.4342 to 1.4327 at 15° C. A direct determination has not yet been made, and this redetermination is reserved for the coming year.

"Dr. Kahle has obtained for the electro-chemical equivalent of silver the value 0.001118 2 (Wied. Annal., Vol. 59, p. 532) by the use of an electro-dynamometer designed by von Helmholtz and a fresh solution of the salt. Pellat and Potier found the same value as that of Patterson and Guthe (Journ. de Phys. 9, p. 381, 1890)."

CORRESPONDENCE.

New York Notes.

New York, September 5.—On the first day of the month the Metropolitan Street Railway company resumed service in Sixth avenue from Fifty-ninth street to Fourteenth street. The change from horse to electrical power was accomplished in 37 days on this section. It was said that the line would be completed from Thirteenth street south to Canal street within two weeks, and from there to the Vesey street terminus in an equally short time. By September 15th, Mr. Vreeland is reported to have said, the road will be reconstructed, equipped and ready for the substitution of electricity for the present animal power.

The Engineers' Club at 374 Fifth avenue was the scene of a dinner given in honor of the engineer officers of Sampson and Schley's fleets on Thursday night. The guests were Chief Engineer John L. Hannum of the Brooklyn, Chief Engineer A. B. Bates of the Texas, Chief Engineer R. W. Milligan of the Oregon, Chief Engineer Charles W. Rae of the Iowa, Chief Engineer W. B. Bayley of the Massachusetts, Passed Assistant Engineer F. M. Bennett of the New York, Passed Assistant Engineer K. McAlpin of the Texas, Passed Assistant Engineer Patton of the New York, Passed Assistant Engineer Leahy of the Oregon, Passed Assistant Engineer Walter Ball of the New York and Chief Engineer Alexander Henderson, United States Navy, retired, of Washington. The dining room was decorated with the national colors and many palms. Two orchestras in adjoining rooms alternated in furnishing appropriate musical selections. President John Thompson of the club, was the chairman of the evening. The dinner was arranged by Passed Assistant Engineer J. C. Kafer, United States Navy, retired, the chairman of the house committee of the Engineers' Club. The dinner was very successful. The distinguishing feature of it was the account given by Chief Engineer Milligan of the work of the Oregon's engines on the memorable voyage around Cape Horn.

Many electrical men are congratulating themselves on the receipt of invitations to Mr. Eugene F. Phillips' clambake. As everybody knows, this is an annual event of the merriest and pleasantest description. This year it will be held on Saturday, September 10th, at Pomham Club, near Providence, R. I. The announcement "Lunch at 11:30; bake opens at 2," is a zest to appetite in itself.

A daily paper states that 13 working models of foreign warships formed part of the cargo of the steamer Tauric, which arrived here last week from Liverpool. The models are the work of Karl Leps, a German naval constructor, and have been on exhibition in Berlin. Each boat is 20 feet long and is propelled by electricity. It is said that they will be taken to Chicago for exhibition on September 12th.

An account of the removal of the mines in the lower end of Long Island Sound states that the first two mines were set off by a raft that was allowed to drift through the channel dragging heavy anchors. The rest were exploded by the transmission of an electric current from the small boat. After the explosions columns of water of great height were thrown into the air and blown toward shore. It was stated that Col. John Jacob Astor's yacht Nourmahal had struck a mine and dislodged it. The mine was secured afterward with a big dent in its side. The electric current that makes a contact mine really dangerous was not turned on at the time the mine was struck. Large quantities of stunned and disabled fish were gathered in by boatmen after the explosions. M. S.

ELECTRICAL SECURITIES.

The Bridgeport Traction company reports that its gross earnings for the last year were $333,409, an increase of $14,435. The operating expenses were $178,188, a decrease of $12,959. This makes the net earnings for the year $27,394 more than in the same period last year.

Both in gross earnings and in operating expenses the annual report of the New York and Queens County Railroad company shows marked increase. The gross earnings were $408,949, operating expenses, $251,277; fixed charges, $254,844.

The gross earnings of the Nassau Electric Railroad company, as shown by the annual statement, were $2,054,080; the operating expenses, $1,259,838, being an increase of $79,044 in the net earnings as compared with the previous year. The company expended $388,428 in improvements and extensions during the year.

The Third Avenue Railroad company, New York, reports the following items for the fiscal year ended June 30, 1898: Gross earnings, $2,506,861; operating expenses, $1,419,206; other income, $104,030; charges, $371,763; balance, $819,922; dividends, $800,000; surplus, $19,922; betterments, $23,666. Cash on hand, $179,540; total surplus, $36,450.

The Albany Railway company's statement of earnings for the year is as follows: Gross earnings, $627,586; net, $228,091; other income, $8,232; charges, $101,219; surplus, $135,104; dividends, seven per cent., $122,500; total surplus, $66,252. The company's report for the second quarter shows: Earnings, $153,558; net, $50,080; other income, $10,252; charges, $27,128; surplus, $32,204, against $43,502 in 1897.

The Buffalo Railway company's annual report contains the following items: Gross earnings, $1,356,494; operating expenses, $678,135; other income, $28,779; fixed charges, $420,348; balance $286,790; dividends, $214,820; surplus, $71,970; betterments, $177,486. The general balance sheet shows cash on hand, $20,867, and a profit and loss (surplus) of $689,589. The Buffalo Crosstown Street Railway company's gross earnings last year amounted to $489,836, and operating expenses $327,002, the net earnings being $10,136 greater than the previous year.

Once more it is rumored that the Central Union Telephone company is about to resume dividends. The company paid a small dividend in 1896, but nothing last year. The affairs of the concern are said to be in a prosperous condition, and an increase in the earnings for the fiscal year is expected to the amount of about $500,000. The earnings of last year were $1,436,898 gross. Operating expenses, which have been very heavy, will be reduced. The rumor that dividends were to be revived last year resulted in a material advance in the stock, but it declined in the neighborhood of 33 when the dividend was passed and has fluctuated in that neighborhood ever since. Now, however, on the promise of dividend it has advanced to 50, where it sold last Tuesday. Prior to 1896 dividends of five per cent. were paid. Many well-informed telephone men contend that the competition the company has experienced precludes the possibility of a dividend for a long time to come.

MISCELLANEOUS.

The Electrical Club of the Young Men's Christian Association of Chicago will give an electrical entertainment on the evening of Septemeber 16th in Association Hall, 151-153 La Salle street. It will consist of an illustrated lecture by F. L. Perry and spectacular electrical effects by George W. Patterson, with musical selections. The entertainment will be free, although a nominal charge is made to those desiring reserved seats. It is given to call attention to the excellent educational work of the club.

TRADE NEWS.

The Dearborn Drug and Chemical Works of Chicago were represented at the street-railway convention at Boston by their vice-president and general manager, Mr. Robert F. Carr.

The American Equipment company of New York will, about October 1st, put one or more standard cars for electric railways in service on the principal roads in prominent cities of the United States, to demonstrate practically approved apparatus for electric railways.

The Chicago Rheostat company presents to the trade a line of standard rheostats recommended for reliability, finish and general excellence. It issues a price list giving the names of the various types, with the prices for the different sizes. E. W. Hammer is the general manager of the company, which has its office at 1649 Marquette building.

The Triumph Electric company of Cincinnati is gratified at the issue of a suit for patent infringement brought against it by the Westinghouse Electric and Manufacturing company. The case was argued before Judge Clark of the United States Court for the Southern District of Ohio, and the decision, as the Triumph company announces, was in favor of the defendant, the Westinghouse patent being declared void.

The Edison Manufacturing company of New York has a fan-motor outfit especially devised for telephone booths. A sound-proof booth is usually hot and close in warm weather, and a fan motor is precisely the indicated remedy. The fan is seven

inches in diameter and is suspended from a bracket by a heavy rubber ring that takes up the vibration. With self-oiling bearings the fan runs so quietly that it is said that the cool breeze is the only indication of its presence. Two styles are made—one for operation from 110-volt lamp circuits and the other for use with a three-cell Edison-Lalande battery.

BUSINESS.

The Central Electric company of Chicago is headquarters for mica products, including mica, mica segments, micanite segments, micanite cloth, empire cloth and M. I. C. compounds. These goods in all forms and types are carried in Chicago stock and can be supplied immediately.

The Warren-Medbery company, manufacturer of inductor alternators, notes a large increase in sales for the month of August. It has made sales in the following-named places this month: Two in Canada, two in New York, one in San Francisco, one in Manitoba, three in Pennsylvania, one in New Jersey, two in New England, three in Texas, one in South Carolina, and one in Tennessee.

The Cutler-Hammer Manufacturing company of Chicago states that its sales for August were larger than for any preceding month in the history of the company. This evidently indicates an increase in the business of the motor manufacturers, to which most of the goods were sold. The Cutler-Hammer company is preparing for a large fall business in rheostats, which is confidently expected.

Dry batteries have been found very useful for signal service in the field. The Western Electric company manufactures the W. E. dry battery, which has a high efficiency and long life and is admirably adapted for emergencies. A large amount of A-1 lap-seamed speaking tube manufactured by the Western Electric company has been used for connection between different stations and forts, it being used as a reserve for the telephone service.

ILLUSTRATED ELECTRICAL PATENT RECORD.

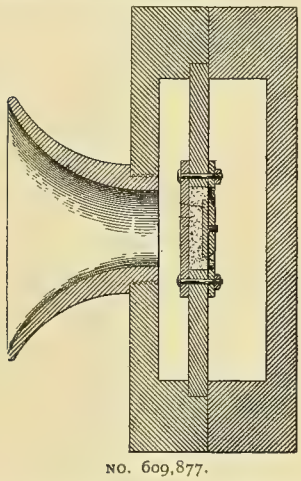
Issued August 30, 1898.

609,851. Electric Locomotion. Henry Van Hoevenbergh. New York, N. Y. Application filed October 10, 1895. Renewed June 23, 1898.

A system of electric locomotion comprising a supply conductor extending along a roadway and a series of trolleys supported thereon for leading current to road vehicles, the trolleys being provided with sloping frames to permit transit over one another and a flexible conductor connected with a traveling vehicle whereby the trolleys may rest by gravity on the supply conductors.

609,853. Railway-rail Joint. Alwin Vietor, Wiesbaden, Germany. Application filed December 27, 1897.

In an auxiliary rail for railway rail joints the head is pressed down at both ends and the web bent out in proportion to the depression of the head.



NO. 609,877.

609,875. Electrode for Medical Purposes. Marian M. Clarke, Wilkesbarre, Pa. Application filed January 8, 1898.

An electrode comprises a suitably shaped metal plate having its surface filled with perforations which are countersunk on the operative face of the electrode.

609,877. Tension Regulator for Electrical Transmission of Speech. Alfred C. Cousens, Newark, N. J. Application filed June 15, 1895.

The method of transmitting sound consists in subjecting to the action of the transmitting current a substance from which is thereby generated a gaseous variable resistance medium, and varying the resistance of the gaseous medium by the action of and to conform to the sound waves to be transmitted.

609,888. Clamp for Electric Wires. Sylvester S. Leonard, Chicago, Ill. Application filed January 24, 1898.

A clamp of the class described consisting of a flexible loop adapted to embrace the glass insulator and a pair of clamping blocks loosely secured to the loop at one end and each provided at the other end with a notch adapted to receive the free end of the wire, the free end being provided with means for clamping it upon the blocks.

609,924. Incandescent Lamp Shade or Cover. Wallace H. Wells, Brasher Falls, N. Y. Application filed March 28, 1898.

A shade for incandescent lamps consisting of a spring metal strip, the ends of which are adapted to clasp the lamp, and a cover secured to the strip and adapted to incase the lamp bulb.

609,972. Hanger for Electric Lamps. William F. Murphy, Iowa City, Iowa. Application filed December 21, 1897.

The hanger described comprises the bracket arms, metallic spindles connected with and extending inwardly from the bracket arms; one spindle having seats, the spool or drum having metallic bushings in its ends snugly receiving the spindles, and also having a gear, and pawls adapted to engage the seats of the spindle, an arbor carried by the bracket arms, a gear mounted on the arbor and meshing with the gear on the spool or drum, a coiled spring surrounding the arbor and having one end fixed with respect to the bracket arms and its opposite end connected with the gear on the arbor, the wires adapted to be connected with an electric device and wound on the spool or drum and the screws connecting the wires to the spool or drum and impinging against the bushings thereof.

609,977. Electric Railway Motor. Albert Schmid, Pittsburg, Pa. Application filed May 10, 1894.

An electric motor having a horizontally divided field magnet, the upper portion of which is provided with an axle bearing at one end and the lower portion of which is hinged to the upper portion, independently of the axle bearing, whereby it may be swung downwardly without disturbing the bearing.

609,990. Means for Controlling Non-synchronous Alternating-current Motors. Benjamin G. Lamme, Pittsburg, Pa. Application filed March 11, 1896.

A variable-speed non-synchronous motor has a comparatively large secondary resistance and a small degree of magnetic leakage between its primary and secondary members, in combination with means for varying the electromotive force applied to its primary member, whereby the speed of the motor is varied.

609,991. Method of and Means for Securing Constant Torque in Polyphase Motors. Benjamin G. Lamme, Pittsburg, Pa. Application filed February 10, 1898.

The method of securing constant torque in an induction alternating-current motor consists in supplying the actuating currents through choke-coils, the magnetic circuits of which become saturated at a predetermined point in the increase of the quantity of current.

610,004. Rail-bond. William H. Talley, Waco, Texas. Application filed November 26, 1897.

A rail-joint is described comprising a suitable rail having a base angle bar located on either side of the rail and having basal flanges, normally in contact with the base of the rail, angular-shaped grooves formed in the basal flanges of the angle bars, and triangular conducting bars located in the grooves and in direct contact with upper surfaces of the base of the rail.

610,007. Contact Device for Electric Railways. Louis E. Walkins, Springfield, Mass. Application filed January 24, 1898.

The combination includes a shoe-supporting frame having suspension supports from the axles, and comprising the articulated supporting member, with springs interposed between the top of the frame and a portion of the car or its truck, a wheel centrally carried by the frame and adapted to run on the top of the third-rail conductor, and a shoe having a depending support from the frame and adapted to bear yieldingly against a sidewise portion of the third rail.

610,008. Contact-rail Appliance for Electric Railways. Louis E. Walkins, Springfield, Mass. Application filed February 2, 1898.

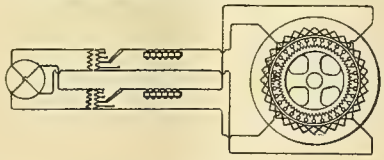
The essential feature is a double-shoe trolley device consisting of a depending trolley support having a roller-carrying yoke to run on the top of the support rail and provided with the oppositely arranged depending inwardly spring pressed shoes, the trolley support being provided at its upper portion with the paired lateral arms having perforations.

610,009. Electric Railway. Louis E. Walkins, Springfield, Mass. Application filed February 2, 1898.

A longitudinally ranging series of transversely axial roller wheels is horizontally arranged, each having a central rim, and at either side thereof an annular section of metal insulated from the central rim. Each of the annular sections has a surrounding collar in contact therewith.

610,016. Electric Switch. Rollin A. Baldwin, South Norwalk, Conn. Application filed March 25, 1897.

In an electrically operated railway switch there is claimed the combination of an electromagnet and its armature, a rod attached to and moving with the armature, a guide adapted to deflect the rod when it is moved by the armature and a switch-moving bar under the control of the guided movement of the rod.



NO. 609,991.

610,023. Automatic Cut-out for Magneto-generators. William J. Bowen and Charles A. Federer, Cleveland, Ohio. Application filed May 26, 1898.

A spindle having a loose wheel mounted thereon, and connected to the magneto generator, a disk of insulating material secured to the spindle, the disk having a notch engaged by a conducting pin upon the wheel, a contact plate within the notch, a connection leading from the contact plate through the spindle to the magneto-generator, and a spring arranged to hold the plate in contact with the pin.

610,025. Alternating-current Motor. Charles S. Bradley, Avon, N. Y. Application filed September 17, 1897.

An electric motor having a primary winding is provided with a plurality of branches, one or more of which includes inductance to set up in the primary core a rotary field when connection is made with a single-phase current, and a secondary element, the winding of which is connected with an adjustable phase-leading device.

610,067. Induction Motor. Benjamin G. Lamme, Pittsburg, Pa. Application filed July 22, 1897.

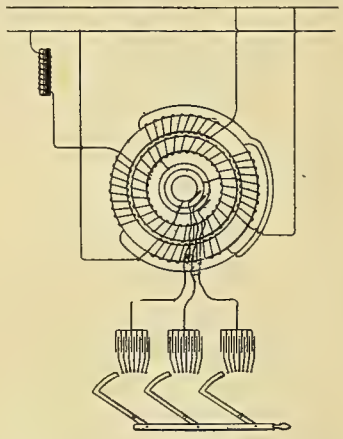
Claim is made for a secondary member comprising a spider, a laminated core provided with slots, bar conductors located in the slots and projecting beyond the ends of the same and resistance rings fastened to the inner sides of the projecting ends of the conductor bars by means of bolts, nuts and spring washers, and provided with ventilating blades, some of which have shoulders engaging the adjacent portion of the spider.

610,077. Ship's Log and Registering Mechanism. Warren H. McCurdy, Boston, Mass. Application filed January 23, 1897.

A ship's log is provided with four electric wires making two independent circuits, the ends of the wires being sealed in the ends of the rubber tubes and intermediately connected by mercury within the tubes.

610,090. Electric Railroad. Benjamin C. Seaton, St. Louis, Mo. Application filed April 5, 1897.

A conductor for supplying current to an electrically propelled car is located above ground and beneath the car and carried between supports made of insulating material, which also form a housing for the conductor adapted to protect the latter against snow, rain, sleet and accidental contact.



NO. 610,025.

610,091. Third Rail for Electric Railways. Benjamin C. Seaton, St. Louis, Mo. Application filed December 7, 1897.

A third rail is formed with a channel in the upper side to receive feed-in wires.

610,092. Contact Device for Electric Railways. Benjamin C. Seaton, St. Louis, Mo. Application filed February 4, 1898.

A contact device for electric railways comprises a bar, a hanger secured to the bar so as to swing horizontally in a vertical plane, and a shoe secured to the hanger and adapted to swing in a vertical plane when subjected to strain.

610,093. Third Rail for Electric Railways. Benjamin C. Seaton, St. Louis, Mo. Application filed February 4, 1898.

A third rail for electric railways has a main conductor and a cap or hood of non-conducting material covered by metallic strips, insulated by the cap or hood from the main conductor and serving as conductors for signal currents.

610,094. Electric Railway. Benjamin C. Seaton, St. Louis, Mo. Application filed February 18, 1898.

A third rail or conductor in combination with a crossing located in a gap in the third rail, the crossing consisting of a hood, channel bars supporting the hood, a conduit inclosed by the hood and bars, and concrete surrounding the conduit.

610,124. Controller for Electric Motors. Harry P. Davis, Pittsburg, Pa. Application filed April 25, 1898.

In a controller for electric motors there is the combination with a resistance-varying switch having revolving brushes and a separate series parallel switch, of gearing between the shafts of the switches, means for operating the first-named switch, a cut-out switch for each motor and means actuated thereby for preventing the operation of the series parallel switch beyond the series positions when a motor is cut out.

REISSUE.

11,689. Electric Circuit Controller. Joseph H. Bowley, Washington, D. C. Application filed March 19, 1898. Original No. 593,510, dated November 9, 1897.

An automatic regulator for electric circuits is described consisting of a receptacle having a base and neck portion, the neck having an upper and lower compartment, a float mounted in the lower compartment of the neck, a standard erected upon the float and in the neck and having fingers designed to engage the ends of the wires forming the circuit.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, SEPTEMBER 17, 1898. No. 12

President Sergeant.

The new president of the American Street Railway association is a street-railway financier and operator of ability and experience. He possesses force of character and is a firm believer in the co-operation of street-railway companies. His idea of the scope of the association's work may be gained by the following extract from a brief speech which he made on accepting the office of president:

"As to this association, I feel strongly that it has a great work to do; that its meetings are not merely pleasant vacations; that it is not called together simply for the purpose of reading and discussing the papers; but I believe that in the complex relations which are continually coming forward between the companies and the municipalities and the state governments and the street railways, that much is to be gained by concerted action. Certainly in Massachusetts we have benefited very greatly from the fact that our street railways have pulled together for what they knew was right; and we have succeeded after a struggle covering many years in obtaining a settlement which I suppose, looked at from all sides, could be called a fair settlement of the relations of the street railways and the community. I hope that the trial which is being made here of this new plan, by which the oppressors of the street railways in a great many communities have been shown by an act of the Legislature how far the street railways are liable to perform work which is not in the line of street-railway practice, and by which the street railways themselves are compelled to pay a portion of their receipts for the benefit of the highways, will prove instructive and mark the beginning of a proper recognition of our industry over the whole country."

Charles Spencer Sergeant is the second vice-president of the Boston Elevated Railway company. He was born in Northampton, Mass., in 1852, the son of George and Lydia (Clark) Sergeant. His father was born in Stockbridge, Mass., which had been the family home since the settlement there in 1735 of his great-great-grandfather as a missionary to the Stockbridge Indians.

Mr. Sergeant was educated in the public schools of Northampton and graduated from the high school in 1868. He began his business career in the employment of the First National Bank of Easthampton in 1872. Afterward he entered the steam-railroad business as paymaster and cashier of the Marquette, Houghton and Ontonagon Railroad company, and was also associated with various iron companies and engaged in the iron-smelting business.

In 1876 he came to Boston to take the position of chief clerk of the Eastern Railroad company, being subsequently appointed general auditor, serving for seven years in the employment of this company. In December, 1887, when the West End Street Railway company came into possession of the several street railways centering in Boston, he was offered and assumed the position of general auditor of the company. Later Mr. Sergeant was advanced to the position of second vice-president, and in November, 1892, he was appointed general manager, which position he held until the lease of the company to the Boston Elevated Railway company.

A Curious Accident.

[From the Minneapolis correspondent of the Western Electrician.]

Charles Hillman carried a banner in the Labor Day parade in St. Paul. The banner pole was surmounted by an American eagle, of iron, and Hillman neglected to lower it when he passed under a trolley wire. The contact was made and the current traveled down the pole to the silk banner and Hillman completed the circuit. He felt a tickling sensation in his feet and found he was unable to move. He lost his footing and fell forward, breaking the connection. The tassels, which touched his face, were badly scorched. Hillman's right arm was strained and hurt in his fall, but he pluckily continued the march.

Local capitalists are projecting an electric railway from East Houghton, Mich., to West Hancock. The company will be known as the Houghton County Street Railway company.

A Chapter of Accidents.

The electricians of western New York seem to have been under an unlucky star recently. On August 31st, in the station of the Lockport Gas and Electric Light company, Chief Night Engineer Thomas H. Farrell in some way caught hold of the two terminals of a 50-light machine and received 1,900 volts of electricity. His body fell forward onto the machine. When rescued he was dead. He was 36 years old, and had been in the employment of the company eight years. He was considered very efficient.

Lawrence Lee, a lineman employed by the Buffalo and Niagara Falls Electric Light and Power company, was working overtime on the night of Friday, September 2d, for the Niagara Falls Hydraulic Power and Manufacturing company in the canal district, adjusting some troublesome wires. It was about midnight when Lee started to cross the hydraulic canal on a walk close to the gate house. This walk narrows near the center, and in the darkness Lee did not notice this fact. He plunged from

CHARLES S. SERGEANT.

the walk into the water between the gate house and the rack. The splash was heard by men in Wallace C. Johnson's office, and a search brought to light Lee's hat. The waste gate of the flume was hurriedly opened in the hope that the body might pass over the cliff into the lower river instead of going into the wheel-pits and onto the turbines, the men not recalling at the time that it would be impossible for the body to enter the wheels, as they are protected by screens. All possible efforts were made to recover the body on Saturday, but it was not until Sunday morning, when the water was shut off, that it was found beneath the Cliff paper mill. Lee was about 35 years old, unmarried.

In the Pearl street station of the Buffalo General Electric company W. A. McEvoy had a narrow escape from death while trying to adjust a belt. The belt had slipped and in trying to fix it he was caught and drawn down. In falling he stretched out his other arm and struck the opposite dynamo. As quickly as possible the engines were stopped and City Electrician H. G. Stott released McEvoy from his position. He was taken to the Fitch Hospital, where it was found he was terribly burned. Both arms were seared their entire length and his back was livid. In some places the current had eaten into the muscle, leaving a hard white scar on the arm. He recovered, after receiving about 1,500 volts.

On Sunday, September 4th, M. B. Marvin, an electrician in the employment of the Bell Telephone company of Buffalo, went to Lewiston to pass the day as the guest of a friend. They decided to go fishing, and Marvin entered one boat in company with a boatman, and his friend another. They rowed upstream along the Canadian shore quite a distance above the site of the old Lewiston bridge. As evening approached Marvin and his boatman started to return in advance of the other boat. They went with the current and it carried them into a rough spot known as the "dasher." The boat was upset, and the two men thrown into the water. Both men were drowned. The boat was picked up as it passed the Lewiston hotels. Marvin was about 38 years old, unmarried, and had been employed by the telephone company for 15 years. He was an expert in his field.

Release of Signal Service Volunteers.

In common with the other volunteers, the men who gave their services to the country as volunteers in the Signal Service Corps are anxious to go home now that (as they consider) the pressing need for their services is over. While this is a very natural sentiment, opinions differ as to the wisdom of acceding to it at present. The Washington correspondent of the New York Tribune represents the situation as follows: "While there is much work to be done in the way of extending and operating the telegraph lines in the newly acquired possessions, Signal Service officials say there is no difficulty in securing enough men. Of the 300 men now in Cuba, it is said two companies could be withdrawn for other fields without detriment. A number of the volunteers in the corps have asked to be discharged, and where their requests are well founded, they will be complied with."

On the other hand, there is a belief that all or nearly all of the men are still needed and some irritation at the manner in which some of the men seek to be discharged. In particular, many applications for discharge papers have been received from the Volunteer Signal Corps attached to General Lee's command at Jacksonville, Fla. The officers complain of demoralization in the corps, owing to the efforts of friends of the Signal Corps Volunteers to secure their discharge from the service, now that the war is over. General Greely, the chief signal officer, has sent this telegram to Lieutenant-Colonel J. E. Maxfield, signal officer at Jacksonville, Fla.:

"Neither the United States government nor the chief signal officer desire to retain patriotic volunteers in service one day longer than public interests demand. The occupation of Porto Rico and Cuba, with extensive governmental telegraph lines to temporarily care for and the creation of division camps throughout the United States, imposes on the Signal Corps additional work instead of lessening it. Discharges in detachments or in large numbers cannot at present be promised, and efforts to secure discharges through political influence is discreditable to soldiers employing it. The chief signal officer will give personal and considerate attention to every application for a discharge coming through military channels, and will recommend discharges of individuals to the extreme point consistent with public interests. Such applicants must give cogent reasons and their applications must be carefully considered by you personally and indorsed without fear or favor. Soldiers with dependent families and who have made pecuniary sacrifices for the country, and also those whose physical condition warrants the belief that they will be of no further service within 90 days, will receive especial consideration as applicants for discharges. The chief signal officer will see that they receive proper attention on receipt here. You will cause this telegram to be read to the command."

One company of the Signal Corps has been ordered by the secretary of war to proceed to Omaha for the purpose of taking part in the exposition. The detail was made in opposition to the recommendation of General Greely, who told the secretary that there was more work for the Signal Corps to do now than at any time since the beginning of the war. The soldiers were sent to Omaha to exhibit the working of a war balloon.

American Electrical Works' Annual Clambake.

On Saturday, September 10th, there occurred for the twentieth time that most enjoyable 'social-business" function known as the annual clambake of the American Electrical Works of Providence, R. I.

In considering the best time during which to give this entertainment the American Electrical Works hit upon the happy idea of having this year's bake follow immediately after the meeting of the American street railway convention at Boston, and this arrangement proved a very happy one. The Friday just preceding the Saturday on which the bake took place had been spent by the hard-working people in closing the exposition, and when Saturday morning came bright and clear there was nothing

AMERICAN ELECTRICAL WORKS' ANNUAL CLAMBAKE —POMHAM CLUB.

to interfere with the closing event of a most enjoyable convention season.

On arriving in Providence the first evidence of the now far-famed hospitality of the Phillipses was evidenced in the delegates being met at the station by special cars upon which they were to ride to the Pomham Club. This ride took the guests through Providence, and gave them an excellent idea of this prosperous city. It is quite a ride over the hills to the Pomham Club, but when one reaches this ideal location for a clubhouse he is well repaid for the long and pleasant journey. The clubhouse proper stands on a high bluff, or point of land, overlooking the water, and the vista is one long to be remembered, dotted as it is with white sails on a background of blue sea and the green of the opposite shore.

To give a detailed description of all that happened in the few hours of the clambake is impossible. Suffice it to say that the moment the delegates arrived entertainment most royal began. On entering the clubhouse and greeting the hosts all hands were directed to check hats, secure an American Electrical Works souvenir cap, register and receive the silken badges. It was astonishing to note the number of badges. It is said that this time there were over 300 people present.

A delicious luncheon was served before noon, and this, as well as the remainder of the entertainment, was enlivened by the strains of music from a fine orchestra. About 2 p. m. a large portion of the company went out to see an ideal clambake, but the hospitality of the hosts would not permit clams to be served on the lawn, so to speak, and within half an hour all hands were "piped" to the bake proper, which was in reality a most delicious dinner with a bill of fare varied by almost every delicacy of the season. The guests were arranged at tables headed by the officers and managers of the various departments of the American Electrical Works and their branch houses throughout the country.

The dinner was concluded by speeches, and no one was spared by the raillery of the several very brilliant speakers. About four o'clock the party began to break up, many of the delegates taking the trains back to Boston and New York.

It has been said by those who have attended before that each of the Phillips clambakes seems to outshine its predecessor of the year before; and this time it seemed as though all records were broken.

Electric Railways in Egypt.

The electric street-car lines are much patronized by the natives and are now probably the most popular means of locomotion in the city of Cairo, according to a correspondent of the Chicago Record. "I believe, though, these lines have only been running for the last two years. The first outlay has already been covered and they are now run at a great profit. So popular are these cars on public holidays that they are absolutely mobbed by the people, who cling to every available bolt, standing on one another, swarming like bees. These cars can vie with the famous Brooklyn trams for being veritable Juggernauts in the sacrifice of human life. The first week the accidents in the streets of Cairo totaled up to 80 killed. Since then the average has been six or seven weekly. This loss of life is not very remarkable, considering that the majority of Cairenes are either deaf or blind in one eye and the tram cars seem to have the road to themselves, for they only stop at their appointed stations."

F. W. Ryan of the Peoria Street Car company proposes an electric line from Spirit Lake, Ia., to Milford, if granted a franchise.

CONVENTION REPORT.

Annual Meeting of the American Street Railway Association at Boston.

Large attendance and great interest marked the seventeenth annual meeting of the American Street Railway association in Mechanics' Hall, Boston, last week. President Lang called the assembled delegates to order on Tuesday morning and introduced Mayor Josiah Quincy of Boston, who made the welcoming address. His honor said that the street railway was an important agency in the promotion of civilization. "Life consists of motion," he explained, "and the more we increase the facilities on the part of mankind to move its individual units from one point of the earth's surface to another point, the more we extend civilization in the higher sense of the term." The mayor spoke of the extent of the electric-railway systems of Boston and its environs and concluded by wishing the delegates and visitors a pleasant sojourn in the city and a generous share of the good things of life in the coming period of prosperity.

President Lang made an appropriate response. The following-named companies were then admitted to membership: Elmira and Horseheads Railroad company, Elmira, N. Y.; Portchester Traction company, Portchester, N. Y.; Portland and Yarmouth Electric Railway company, Portland, Me.; Portsmouth Street Railway company, Portsmouth, Va. During the convention the following-named companies joined the association: Warren, Brookfield and Spencer Street Railway company, Warren, Mass.; Brockton, Bridgewater and Taunton Street Railway company, Boston, Mass.; Providence and Taunton Street Railway company, Taunton, Mass.; Milford, Holliston and Framingham Street Railway company, Framingham, Mass.; South Chicago City Railway company, Chicago, Ill.; St. Joseph Railway, Heat, Light and Power company, Gloucester, Mass.; Fairhaven and Westville Street Railway company, New Haven, Conn.

President Lang's Address.

In his annual address Mr. Lang briefly reviewed the history of the association and enumerated the cities in which the meetings had been held. He then continued:

Having laid in this city the foundation of the splendid structure we have since reared, it is very proper that we should return and dwell therein for a few days. Everything gives promise of this being the largest meeting in our existence. If we do not make it one of the most valuable, the fault will be with ourselves. Let us hope to leave such an impression that the Boston people will say, "It was good to have them with us."

In the growth and development of our association and the business we represent let us not forget the priceless and unrivaled assistance rendered by the technical press. Without a spokesman, a guardian ever faithful to our interests, as it has been, our progress would have been much slower and our pathway exceeding rough. All honor to these devoted publishers and editors.

Nor must we for a moment forget (if we could) the indefatigable supply man, for he is the noblest Roman of them all. It is his courage, foresight and energy in taking up the new and useful article and pressing it upon our attention that helps to effect economies. We may sometimes be prematurely persuaded, but that is not the fault of the supply man; it is simply one of the arts of his trade and necessary for us to learn. But, seriously, without them the meetings of our association would be materially weakened and lose much of their interest and value. Let us then not fail to give them and their exhibits all the attention and examination time will permit.

The executive committee has prepared a very excellent list of papers to be read, and I trust that all will join in giving them generous discussion. Some of the writers of the papers have told me that they expected more benefit would be derived by members from discussion than from the paper itself. This should be inducement enough to keep all in constant attendance. Bear in mind that in so doing we are also promoting the best interests of the association, as well as honoring the writers of the papers, which is their due and our duty. While on this subject let me here call attention to the necessity of having at our meetings papers which will interest all the members—not only the mechanical and electrical engineers, but the general managers and even presidents of companies. We need all these officials with us at every convention; hence we must provide something of interest to them.

Each and every member must be made to feel that he has been benefited by attending our conventions, and likewise the company represented, or our association will cease growing. As a result of our deliberations economies should follow, without injury to the public service, all of which will tend toward a further realization of the objects of our association, which are "the establishment and maintenance of a spirit of fraternity among the members," and in the largest degree "the encouragement of cordial and friendly relations between the roads and the public."

Under the head of general business, as provided in our by-laws, or at some other appropriate time, a sort of experience meeting or informal discussion of all subjects relating to our business should take place, where each member shall feel free to ask any question that occurs to him upon which he desires information, and someone may stand ready to answer.

I venture to suggest a few subjects arising almost daily, upon which, in this way, very helpful information could be obtained, namely:

"The suburban railroads: on what terms and conditions should they enter over our tracks and how can their building be encouraged?"

"The issuing of transfer checks or tickets and how abuses connected therewith can be limited."

"The equipping of buildings with automatic sprinklers and the economy resulting therefrom."

"The cast or electric welding of rail joints and the saving effected in current and cars."

"The discussion or agitation of municipal ownership of franchises, and the most intelligent way to treat the subject."

"To what extent companies should engage in the amusement business, and the best methods of conducting the same."

"A comparison of the cost of materials and supplies and expenses of operation."

"How best to promote the interests of employes and in return secure from them the highest degree of service and loyalty."

These and many other subjects of kindred nature considered in this manner would awaken great interest.

I desire to call attention to our fellow workers and associates, the Accountants' association, which holds its meetings simultaneously with ours each year, and is even now in session in another part of the building. The whole business of the street rail-

AMERICAN ELECTRICAL WORKS' ANNUAL CLAMBAKE.—MR. PHILLIPS' GUESTS.

way revolves around the accountant's office, and many of us can attest the value of having efficient persons in charge thereof. It is with the hope of enabling them to make their services more valuable to their respective companies that the association was formed; hence they should receive every assistance it is possible for us to render. I bespeak for them your cordial co-operation.

In closing I wish to thank our efficient secretary and the executive committee for their cordial aid and support during the year, and to assure the members of the association of my great appreciation of the honor of being called a year ago to the office of president.

Reports of Committees and Officers.

The executive committee reported the business it had transacted during the year. One matter disposed of related to the lighting of railway parks and pleasure resorts from trolley circuits, brought before the association by the Houston Street Railway company. In some cities this is allowed and in others the practice is forbidden. The secretary was instructed to notify the manager of the Houston company that the executive committee considered the issue entirely local and that it did not think that it should take any part in it.

The committee recommended the following rules of order, which were adopted:

1. No member will be recognized by the president unless he shall announce distinctly his name and address.
2. Speeches will be limited to 10 minutes unless the time shall be extended by the convention.
3. Members who desire to offer resolutions or other matters to be considered by the convention are requested to submit them in writing over their signatures to the secretary.

W. C. Ely presented the following, which was adopted by the committee and the association: "Pursuant to authority conferred upon this committee by the convention of 1897, an investigation, of the question of municipal ownership has been instituted, and, in response to inquiries sent out by the secretary, much valuable data and information upon the subject have been secured. But owing to the extent of the field necessary to be covered, and also to the desirability of absolute accuracy in the evidence to be presented, and in order that the form of its presentation shall be such, as to order of arrangement, conciseness of detail, etc., as to render the same of the greatest value, it has been thought best to ask for further time in the matter; and your committee would therefore recommend that the subject be left in the hands of the committee until the next annual convention, and in the meanwhile any member so desiring may have access to the data in the possession of the secretary in its then existing form."

It was noted that every officer of the association and member of the executive committee attended the meeting of the committee on Tuesday morning, before the association assembled. This is unprecedented in the history of the organization.

T. C. Penington, the secretary and treasurer, reported receipts from October 18, 1897, to August 25, 1898, $9,307.65; expenses for the same period, $5,651.37; balance on hand, $3,656.28. The number of company members is 161, the gains and losses of the year exactly balancing. The deaths of the following-named gentlemen during the year were recorded: J. A. Stratton, secretary and treasurer Birmingham Railway and Electric company, Birmingham, Ala.; Reuben F. Baker, president Columbia City Railway company, Washington, D. C.; Frank S. Stevens, Globe Street Railway company, Fall River; Morris W. Hall, secretary Camden and Suburban Railway company, Camden, N. J.; Charles B. Pratt, president Worcester Consolidated Railway company, Worcester, Mass.; Julius S. Grinnell, general counsel Chicago City Railway company, Chicago, Ill.; M. W. Squires, ex-superintendent North Chicago Street Railway company, Chicago, Ill.; C. B. Reavis, secretary and treasurer Augusta Railway company, Augusta, Ga.

Reading of Papers.

The first paper was on "Comparative Earnings and Economy of Operation Between Single and Double-truck Cars for City Use," read by Richard McCulloch, the electrical engineer of the Cass Avenue and Citizens' Street Railway company of St. Louis. The paper was discussed by Messrs. McCormack of Brooklyn, Beggs of Milwaukee and others.

On Wednesday morning Mr. W. S. Dimmock, general superintendent of the Omaha and Council Bluffs Railway and Bridge company of Council Bluffs, Ia., read a paper on "Carrying of United States Mail Matter on Street Railways." This important subject was thoroughly discussed. The secretary then read Mr. M. S. Hopkins' paper on the "Maintenance and Equipment of Electric Cars for Street Railways," in the absence of the author, who is the electrician of the Columbus Street Railway company of Columbus, O. A brief discussion followed this paper.

Mr. Walton H. Holmes, the general manager of the Metropolitan Street Railway company of Kansas City, read his paper, "To What Extent Should Street Railway Companies Engage in the Amusement Business?" on Thursday. Mr. C. D. Wyman of New Orleans opened the discussion at the request of the president, and others followed.

Secretary Penington read Mr. Frederick D. Perkins' paper on "Inspection and Testing of Motors and Car Equipments by Street Railway Companies." The author, who is the electrical engineer of the Toledo Traction company, was present but was indisposed. Owing to the lateness of the hour the paper was not discussed.

The last paper read was by Mr. R. W. Conant, electrical engineer of the Boston Elevated Railway company, whose subject was "Cost of Electric Power for Street Railways at Switchboard, both Steam and Water." Mr. Conant read his paper on Friday morning. He was highly praised for the arduous work of preparation.

Courtesies of the Convention.

Mr. W. Caryl Ely, the first vice-president of the Street Railway Association of the State of New York, invited the members of the American Street Railway association to meet with the state association at its convention of September 13th and 14th at Manhattan Beach. The invitation was accepted with thanks.

On Thursday an invitation to attend the exhibition was sent to the International Association of Factory Inspectors, then in session.

The Boston Elevated Railway company invited the delegates to visit any of its various power plants, shops, car houses, etc., and stated that special instructions had been issued to have particular attention shown to the visitors.

Thanks were cordially extended, on behalf of the association, to the members of the Massachusetts Street Railway association and the local committees for the entertainment in Boston. In making the motion, ex-President Payne of Milwaukee said: "I think it is not too much to say that the arrangements for this convention have not been excelled in any place where we have met, certainly not where I have been in attendance upon the meeting." The retiring officers of the association, the ladies' reception committee and the press of Boston were likewise accorded special votes of thanks.

EXHIBITS AT THE BOSTON STREET RAILWAY CONVENTION.—VIEW IN MAIN HALL.

Miscellaneous Items.

A special committee was appointed to consider the general subject of carrying United States mail on street cars, to obtain information from the different cities and to confer with the Postoffice Department if necessary. This committee consists of John T. Burnett, Boston; Henry C. Payne, Milwaukee; Ira A. McCormack, New York; D. G. Hamilton, Chicago, and W. S. Dimmock, Council Bluffs.

At the opening session Mr. Kelly of Columbus made the interesting suggestion that all the members who were present at the organization of the association in Boston in 1882 rise to be counted. Messrs. W. Worth Bean of St. Joseph, Mich., George B. Kerper of Dayton, O., and Julius E. Rugg of Boston proved to be the only veterans present.

The president announced that it was the desire of the secretary that members of the association should indicate topics upon which it would be desirable to have papers prepared for the next convention and that they should also suggest persons to prepare the papers.

Japanese Visitors.

At Thursday's session President Lang announced that Mr. T. Y. Dzushi, chief of finance and manager of stores of the imperial government railways of Japan, and Mr. K. Sugahara, chief engineer of the Kobu railroad and of some street railroads soon to be built in Japan, were attending the convention. The visitors were given the privileges of the floor and invited to address the association. Mr. Sugahara responded in the following terms:

"It is a great privilege and honor to have the pleasure of meeting you on this memorable occasion and to occupy a seat in this national convention of street railways in this great country. I desire to express my sincere gratitude for your hospitality extended to me as well as to my friend Mr. Dzushi. Indeed, it is very difficult for me to express my feeling and sentiment to my heart's wish, because I am not accustomed to your language. However, I believe it will be some entertainment to you to know that an alien from the Land of the Rising Sun ventures to speak in broken English instead of her flowering and poetic language.

"Japan is achieving a great deal in her material progress and is striving to accomplish in rapid succession what she learns from abroad. Your venerable Commodore Perry opened our gate toward western civilization some 44 years ago, and to-day your generous discoveries and inventions lead us hand in hand to the march of material civilization, for which we are greatly indebted to your people and country. To tell you of my experiences regarding the construction of street railways in Japan, I may say that I was the first engineer of a private company to build steam street railways for passenger traffic in Tokyo in 1896 and since then. I am naturally devoted to the investigation of street-railway construction, and you can hardly imagine how interesting and helpful it is to me to be present at this great convention.

"The progress of our street-railway system is very slow, and the roads are in a primitive stage as yet. For instance, they are only about 60 miles in length and most of them depend on horse power, except the Kyoto and Nagoyo electric lines. Several electric railways, however, have been projected in different cities and towns throughout the country. We are firm in our belief that in the near future Japan will be found a network of electric street railways. Should I engage on Tokyo street railways after returning home and apply the knowledge I have gained here, I shall be very much indebted to you all, and must pay cordial thanks. We have about 40,000 jinrikshas and 90,000 wagons drawn by men as the means of transportation in Tokyo, which greatly interferes with the progress of street railways. Notwithstanding these difficulties, Tokyo horse-car railway companies pay on the capital invested 30 per cent. dividends annually, and our steam-road company 13 per cent. We have no doubt that the building of street railways in Tokyo is one of the most promising enterprises. It is my great desire that our country shall progress in such a degree that when any of you shall come to Tokyo you may go to any place in the city by street cars, not by jinriksha, and that our country may be seen as one of the industrial countries of the world and not only as a country of beauty and curiosity."

The president of the association reciprocated the sentiments of esteem of the Japanese engineer. Mr. Dzushi also spoke briefly.

Standard Rules for Employes.

The committee on "Standard Rules for the Government of Conductors and Motormen" presented a verbal report through Mr. McCormack of Brooklyn. The committee has formulated a set of rules. These rules will be sent to each member of the association for criticism and advice, and then, with the suggestions, come up for adoption next year. The committee was continued and the sum of $200 was voted to it to pay for the printing and mailing of the tentative code of rules.

Next Convention to Be in Chicago.

Chicago was chosen as the place for the annual meeting of 1899 by the committee on nominations.

and the choice was ratified by the association. Detroit and Kansas City were also candidates. The secretary read letters from the Detroit Citizens' Street Railway company, the Detroit Electric Railway company and the Fort Wayne and Belle Isle Railway company, Detroit, inviting the association to meet in Detroit next year. Messrs. Holmes and Morse extended verbal invitations for Kansas City.

When the report was adopted, Mr. John Farson, president of the Calumet Electric Street Railway company, pledged the street-railway men of Chicago to do everything in their power to make the coming convention interesting, profitable and instructive. "We will welcome you, gentlemen," he said, "with open arms."

NEW OFFICERS.

In accordance with the recommendation of the nominating committee, these officers were elected:

President—Charles S. Sergeant, second vice-president Boston Elevated Railway company, Boston.

First vice-president—Henry C. Moore, president Trenton Street Railway company, Trenton, N. J.

Second vice-president—Ernest Woodruff, president Atlanta Consolidated Street Railway company, Atlanta, Ga.

Third vice-president—Walton N. Holmes, general manager Kansas City Railway company, Kansas City, Mo.

Secretary and treasurer—Thomas C. Penington, treasurer Chicago City Railway company, Chicago, Ill.

Executive committee—Albion E. Lang, president Toledo Traction company, Toledo, O.; George A. Yuille, second vice-president West Chicago Street Railroad company, Chicago, Ill.; Frank Jones, president Memphis Street Railway company, Memphis, Tenn.; John I. Beggs, general manager Milwaukee Railway and Light company, Milwaukee, Wis.; Ira McCormack, general superintendent Brooklyn Heights Railway company, Brooklyn, N. Y.

EXHIBITS AT THE BOSTON STREET-RAILWAY CONVENTION —LOWER HALL.

CONCLUDING BUSINESS.

At Friday's meeting the new president, Mr. Sergeant, was installed. He was introduced by Mr. Lang and made a little speech thanking the association for the honor and briefly referring to the importance of the co-operation of street-railway companies in practical work. Mr. Lang then yielded the gavel to the new president, and, on motion, the association stood adjourned.

ENTERTAINMENT FEATURES.

Several side trips from Boston—to Concord, Lexington, Plymouth, Nantasket Beach, the parks and other points—were planned by the local committees and carried out to the enjoyment of the visitors. There was a reception to the ladies and gentlemen from out of town on Tuesday evening, and the annual banquet was given at the Hotel Brunswick on Thursday evening.

Delegates in Attendance.

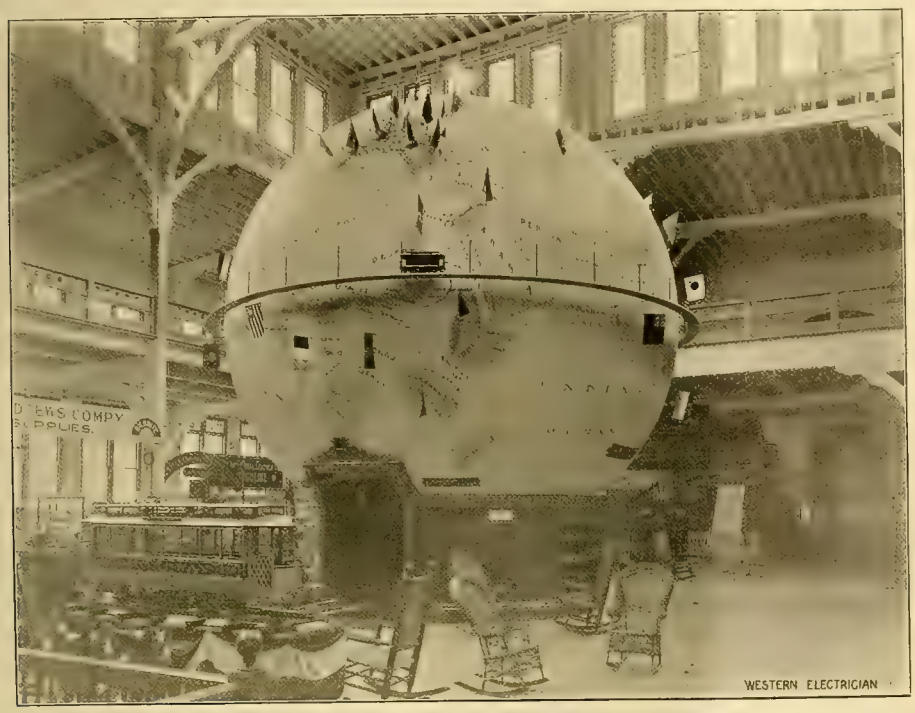
Following is a list of the delegates from the company members of the association in attendance at the Boston convention:

Allentown, Pa.—A. F. Walter, Jilson J. Coleman.
Alton, Ill.—J. F. Porter, H. H. Harrison.
Atlanta, Ga.—E. Woodruff, J. Carroll Payne, Thomas Elliott, N. W. L Brown.
Baltimore, Md.—P. O. Heilholtz, J. M. Christopher, D. E. Evans.
Battle Creek, Mich.—E. Hope Norton, Fred I. Griswold.
Bay City, Mich.—W. R. Morrison, R. S. Ashe.
Binghamton, N. Y.—G. Tracy Rogers, J. P. E Clark.
Boston, Mass.—William A. Bancroft, Charles S. Sergeant, R.H. Derrah, J. H. Goodspeed, J. E. Rugg, John Balch, Charles H. Bigelow.
Bridgeport, Conn. Andrew Radel. George H. Sanford.
Brockton, Mass.—Horace B. Rogers, John P. Morse, A. C. Ralph, A. B. Williams, P. W. Sprague.
Brooklyn, N. Y.—Clinton L. Rossiter, Ira A. McCormack, J. H. Van der Veer, M W. Conway, Albert L. Johnson, William F. Ham, Frank S. Drake.
Buffalo, N. Y.—George Chambers, Robert Dunning, R. E. Danforth.
Butte, Mont.—Jesse R. Wharton.
Camden, N. J.—G. G. Browning, Walter E. Harrington.
Charleston, S. C.—F. D. McEowen, T. W. Passailaigue, A. S. Bayer.
Chicago, Ill.—John Farson, H. M. Sloan, T. C. Penington, Frank R. Greene, G. W. Knox, C. J. Reilly, A. C. Heidelberg, Charles E. Moore, Walter V. Penington, J. J. O'Keefe, G. O. Nagle, John M. Roach, James R. Chapman, John Millar, George A. Yuille, W Frank Carr, William Walmsley.
Cincinnati, O —Bert L. Kilgour.
Cleveland, O.—John Ehrhardt, H. J. Davies, W. G. McDole.
Colorado Springs, Col.—A. L. Lawton.
Columbus, O.—W. F. Kelly, P. V. Burington.
Council Bluffs, Ia.—W. S. Dimmock.
Dayton, O.—George B. Kerper, George B. Kerper, Jr.
Derby, Conn.—H. Holton Wood, B. W. Porter.
Detroit, Mich.—J. C. Hutchins.
Elmira, N. Y.—J. B. Cahoon.
Findlay, O —Charles D. Kinney, Charles F. Smith.
Fall River, Mass. Robert H. Goff, H. H. Read, J. H. Bowker, G. W. Palmer, Jr.
Galveston, Texas.—F. W. Fratt.
Girardville, Pa.—E. W. Ash, C. A. Bragg.
Gloucester, Mass.—W. B. Ferguson.
Hamilton, Ont.—V. H. Waggoner, J. F. Little.
Harrisburg, Pa.—F. B. Musser, Mason D. Pratt.
Hartford, Conn.—E. S. Goodrich, Elmer M. White.
Hazleton, Pa.—A. Markle, G. W. Thompson.
Hoboken, N. J.—G. T. Lister, W. S. Hall.
Houston, Texas—A. H. Parlin, Newton Jackson.
Indianapolis, Ind.—Miller Elliott.
Jersey City, N. J.—Charles Y. Flanders, Ralph H. Beach.
Johnstown, Pa.—H. C. Evans.
Kalamazoo, Mich —L. N. Downs, Dee Allen, F. N. Rowley.
Kansas City, Mo.—Charles F. Morse, W. H. Holmes.
Lansing, Mich.—Lawrence Barrett.
Lawrence, Mass.—Alfred A. Glasier. N. E. Morton. Franklin Woodman.
London, Ont.—C. E. A. Carr.
Long Island City, N. Y.—J. R. Beetem.
Lowell, Mass.—P. F. Sullivan, Percy Parker.
Lynn, Mass.—C. M. Wicker, Amos F. Breed, E. C. Foster, H. C. Page, William Pestell, H E. Farrington.
Manchester, N. H.—E. P. Shaw, Jr., N. H. Walker.
Memphis, Tenn.—F. G. Jones, C. A. Ruddock.
Meriden, Conn.—N. H. Heft, G. Stanley Heft, Charles P. Clark, John Henney, William Appelyard, J. Smith, John F. Vaughan, Dr. F. B. Devons, E. C. Boynton.
Mexico (City of), Mexico.—Arthur S. Partridge.
Milwaukee, Wis.—Henry C. Payne, John I. Beggs, T. E. Mitten, H. C. Mackay, E. W. Olds.
Minneapolis, Minn.—J. F. Calderwood.
Mobile, Ala —J H. Wilson
Milford, Mass.—W. B. Ferguson, G. A. Butman.
Nashville, Tenn —E. G. Connette, George Swint.
Newark N. J —W. H Adams.
New Bedford, Mass.—E. E. Potter, I. W. Phelps, A. C. Gardiner.
New Britain, Conn.—Lincoln S. Risley
New Brunswick, N J.—Edward H. Radel, R. L. Rand.
Newburyport, Mass.—Charles Odell, W. P. Clark.
New Orleans, La.—C Densmore Wyman.
New Haven, Conn.—L. Candee.
Niagara Falls, N. Y.—C K. Marshall.
Norfolk, Va.—R. Lancaster Williams, D. H. Hegarty.
North Tonawanda, N. Y.—W. Caryl Ely.
Norwalk, Conn.—William F. Acton, A. B. Hill.
Norwich, Conn.—W. A. Tucker, P. L. Saltonstall, W. L. Adams.
Omaha, Neb.—D. H. Goodrich.
Philadelphia, Pa.—J. C. Lugar, W. H. Janney, John A. Brill.
Pittsburg, Pa.—J. G. Carroll.
Port Huron, Mich.—William Canahan, W. L. Jenks.
Portsmouth, Va —Horace G. Williams.
Portland, Me.—William R. Wood, A. Whitney, Charles F. Libbey, E. W. Newman, L. B. Wheildon, W. G. Wheildon.
Providence, R. I.—A. T. Potter, Henry V. A. Joslin, A. E. Potter, M. H. Bronsdon, W. D. Wright.
Port Chester, N. Y.—W. J. Clark.
Quincy, Ill —E. K. Stone, Jr., C. E. Stone.
Quincy, Mass.—John R. Graham, Fred. W. Smith, Benjamin J. Weeks, A. D. Gore, D. J. McLane.
Reading, Pa.—John A. Rigg, S. P. Light, W. R. McIlvain, R. E. Moore.
Richmond, Va.—E. Randolph Williams, P. L. Williams.
Rochester, N Y.—J.W. Hicks, LeGrand Brown, . H. Stedman.
Rockland, Me.—Thomas Hawken, H. C. Weston, F. B. Lee, Valentine Chisholm.
Sioux City, Ia —Chester P. Wilson.
Springfield, Mass.—George W. Cook, George S. Webb, George F. Reed, F. E. Sarrin.
Springfield, O.—S. L. Nelson, L. O. Williams, L. F. Purcell.
St. Joseph, Mich.—W. Worth Bean.
St. Joseph, Mo.—W. T. Van Brunt, J. H. Van Brunt.
St. Louis, Mo.—D. G. Hamilton, Robert McCulloch, Richard McCulloch, Bruce Hamilton, Frank J. Duffy, F. B. Brownell, Harry Scullin, C. H. Pierson.
Syracuse, N. Y —William H. Tucker.
Taunton, Mass.—S. M. Thomas, George F. Seibel.
Toledo, O.—Albion E. Lang, E. J. Bechtel, George A. Cooke, Fred B. Perkins
Topeka, Kan —Albert M. Patton.
Trenton, N J —Henry C. Moore, P. E. Hurley, R. S. Woodruff Samuel Moore.
Wakefield, M ss —C. W. Holmes, W. M. Butler, Joseph F. Shaw.
Washington, D. C.—R. W. Palmer, Theodore J. King, A. B. Coppes.
Waterbury, Conn. —M. E. Stark.
Webb City, Mo.—F. H. Fitch, H. P. Fitch.
West Haven, Conn.—Albert E. Pond, Israel A. Kelsey.
Wilkesbarre, Pa.—John Graham, J. C. Meixel, James Fagan, P. R. Raife.
Williamsport, Pa.—Ernest H. Davis, Charles T. Herrick, James O. Goole.
Worcester, Mass.—Francis H. Dewey, A. H. Stone, John N. Akarman.
Warren, Mass.—M. S. Myrick, C A. Richardson, C. A. Jefts.
York, Pa.—Charles H. Mayer, W. H. Lanius.
Youngstown, Ohio.—A. A. Anderson.

Exhibits and Exhibitors.

At the end of the main hall, where nothing intervened between the floor and the rooftree, an immense globe was erected by the General Electric company to serve as an exhibit, not so much of its great facilities, as of the world-wide use of its apparatus. This company did not consider it necessary to make any special exhibit of its apparatus, as all the great dynamos now used to furnish current to drive the street cars of Boston were built in its works, almost every motor is of its manufacture, and, with few exceptions, every switchboard and controller. The Boston elevated-railway system has in use examples of the latest types of the company's electric-railway machinery, built either at Lynn or as Schenectady, and, like the work of Sir Christopher Wren in London, if inquiry were made for the monument of the General Electric company, the visiting delegate had but to look around him. The huge globe, representing the earth, was built up of papier maché upon a framework of wood, and rested upon a black pedestal picked out with gold. The continents and oceans were plainly depicted by the scenic artist at the Boston Theater. The globe was built in 54 distinct sections to a scale of 312 miles to 12 inches; it was 25 feet two inches in diameter, and weighed three tons. It stood on a pedestal 16 feet in diameter,. The north pole was indicated by an incandescent lamp of 100 candle power. Two thousand seven hundred square yards of papier maché, in nine layers of 300 square yards each, were employed in the construction of the globe, the building of which occupied just two months. Dotted over the globe, thickly in the United States, less thickly in Europe, and sparsely in the less civilized countries, were small incandescent lamps of different colors, each lamp representing the location of some city in which the General Electric company has some typical installation. Four hundred lamps were employed. So far as the number of plants was concerned, thousands of lamps would have been required to give an idea of the ramifications of the business of this company over the globe, but as each lamp receptacle covered about one square inch on the globe, or what would mean on the earth's surface 500 square miles, 400 lamps sufficed. Had the requisite number of lamps been employed, New England alone on this globe would have been covered with closely set lamps 30 to 40 tiers high from the surface. The installation included those for street-car propulsion, for mill or mine work, or for lighting purposes. No better idea of the extent to which American ideas on matters electrical have permeated throughout the whole earth could possibly be gathered than from a glance at this globe, and the mind reverted to the names of Edison, Thomson, Vandepoele, Sprague, Brush and others whose practical genius made this world-wide use of electricity possible. Each country was indicated by its national flag, and the Stars and Stripes fluttered not only over the United States, but also over Cuba, Porto Rico and the Sandwich and Philippine Islands. The interior was richly upholstered, the decorative color scheme being worked out in pink and green. The air was kept cool by revolving electric fans, and the lighting of the interior was all indirect. An aurora-borealis effect was secured over the north pole of the globe, both inside and out, by groups of small orange-red lamps; and the southern polar light was represented by a row of lamps concealed between the globe and the pedestal. Indeed, the globe seemed to issue from the glowing mass below, in accordance with the beautiful theory of nebular generation. The course of the sun around the globe was marked by a small track occupying the plane of the ecliptic, upon which, once a minute, traveled a miniature trolley car, labeled "World Circuit." The globe will remain in place during the Mechanics' Fair, and will then be taken down and sent to Paris, where it will occupy a prominent position in the electrical building at the exposition of 1900. The space behind the globe was set out with comfortable chairs for the benefit of visitors. Here, also, was set up a model plant to show the practical working of the Thomson car-recording meter, consisting of a G E 800 motor, an R 11 controller and the necessary resistances, the car meter, fuse and a form M circuit breaker. The load was applied to the motor by means of a brake working on a pulley keyed to the armature shaft. Behind this plant was an instrument board, on which were exhibitied the latest types of astatic volt and ampere-

meters, inclined-coil switchboard and portable instruments, motor-vehicle meter and edgewise ammeter, all grouped around a type M station recording wattmeter reading to 8,000 amperes. On an easel a framed sign showed the railroads in the vicinity of Boston employing General Electric apparatus and the details of their equipment. Above the instrument board hung another illuminated sign —the complement of the globe—setting forth the railway record of the company, which has manufactured and sold up to September 1, 1898, 2,285 railway generators, aggregating 423,101 horse power; 52,841 railroad motors, aggregating 1,270,865 horse power, and 50,000 series parallel controllers. Let into the pedestal of the globe were two spaces fitted with shelves, on which were shown the most recent types of overhead material, circuit breakers, lightning arresters, etc. The entire convention hall was lighted from General Electric enclosed arc lamps. Headquarters were established in the Hotel Brunswick, where, in the Venetian room, several albums containing photographs showing the wide diversity of General Electric work and a fine collection of medals and diplomas were set on the tables. Mr. W. J. Clark, general manager of the railway department, had the interests of the General Electric company in his care. Mr. Clark was assisted by the following-named representatives of the company: C. B. Davis, F. M. Kimball, C. C. Pierce, C. D. Haskins, S. B. Paine, G. E. Steele, of the Boston office; R. H. Beach, T. Beran, J. J. Mahoney, T. A. Branion, W. G. Bushnell, New York office; Theo. P. Bailey, Chicago office; G. D. Rosenthal, St. Louis office; H. J. Crowley, Philadelphia office; A. D. Babson, Baltimore office; H. T. Heywood, Atlanta office. The supply department at Schenectady was represented by J. R. Lovejoy, general manager, H. C. Wirt, engineer, and J. K. Aitken; the railway department by W. B. Potter, chief engineer, F. E. Case, E. D. Priest, L. C. Batchelder and C. A. Barry; the patent department by A. J. McDonald.



EXHIBITS AT THE BOSTON STREET-RAILWAY CONVENTION.—GREAT GLOBE OF THE GENERAL ELECTRIC COMPANY.

Cleveland appeared in the presence of E. B. Merriam of the Paragon Insulating company.

"Gold Bond Jimmy" Atkinson came along over the Wabash and brought his gold bond with him.

George D. Rosenthal, St. Louis agent of the General Electric company, came in from St. Louis on Wednesday.

The Fuel Economizer company of Matteawan, N. Y., was there in the shape of models, drawings and blue prints.

Western Manager J. M. Hill of the Bryan-Marsh company was also in Boston at the time of the street-railway convention.

Engineer Clift Wise came down "over the Wabash;" and on this trip, it is said, he added 100 friends to his already long list.

W. P. Cosper, general agent at St. Louis of the Consolidated Car Heating company of Albany, N. Y., came in from St. Louis Monday evening.

General Manager James A. Brett also accompanied the Chicago delegation and did the honors for the Electrical Installation company of Chicago.

The Electrical Railway Equipment company of Cincinnati presented a line of handsome iron poles, brackets and trolley fittings. These were under the care of Elmer P. Morris, the company's eastern agent, and it is needless to say they were well presented.

Where was W. R. Garton, president of the W. R. Garton company of Chicago? It had been expected until the last moment that Mr. Garton would appear.

The Cutter Electrical and Manufacturing company of Philadelphia was represented by Mr. William M. Scott, and a full line of circuit breakers was presented.

Secretary Henry C. Adams, Jr., came up from Pawtucket and spent his time entertaining royally a host of friends of the Phillips Insulated Wire company.

Townsend Church, one of the best-looking and most courteous men at the street-railway convention, did the honors in truly royal style for Julian L. Yale & Co. of Chicago.

Was Sears B. Condit, Jr., on hand? Someone said he was never absent from any convention, and in this case, as usual, the genial and courteous manager of L. A. Chase & Co. was there in "full feather."

Le Valley Vitæ Carbon Brush company of New York was represented in the person of E. J. Prelin. Mr. Prelin distributed catalogues, and, in his usual inimitable manner, made many friends for his company.

The Sterling Supply and Manufacturing company of New York was represented by Messrs. F. A. Morrell and L. D. Nelson. The company had in particular five different styles of registers on exhibition. The business at the convention, for this institution, proved most excellent, with even better prospects ahead.

Mr. Hubbard of the McGuire Truck company was everywhere, and it is safe to say no one passed by the heavy machinery under his care. It was too bad that Mr. McGuire himself was unable to appear at the convention.

The Albert and J. M. Anderson Manufacturing company of Boston had a most handsome exhibit, under the management of C. B. Pear. The exhibit consisted of a great variety of specialties, line material and insulators.

Manager George Weston, of the construction department of Naugle, Holcomb & Co. was on board the convention train and came down over the Wabash from Chicago to Boston. Mr. Weston was in daily attendance at the convention.

Secretary King of the Ohio Brass company was, as usual, indefatigable in his efforts to push his company's products. The Ohio Brass company succeeded in securing for itself a booth in one of the finest locations in Exposition Hall.

The Shawmut Fuse Wire company shows a line of fuses, both of the enclosed and open type; also a fine line of knife switches. The company calls attention to its enclosed fuse for car-heating work. The exhibit is in charge of Mr. H. P. Moore.

The Jandus Electric company made an attractive exhibit of its lamps in the space occupied by the Creaghead Engineering company of Cincinnati. The Jandus exhibit, however, was under the charge of the New England manager, H. T. Edgar. Mr. Edgar was on hand daily, explaining the novel features of the Jandus lamp. The strong claim which the company is now making is that its enclosed lamp consumes no more than 75 cents' worth of carbons per year, and on this claim alone the company has made most extensive sales.

Of course A. L. Daniels of the H. B. Camp company of Aultman, O., was at Boston. As is now very generally known, Mr. Daniels is the ubiquitous representative who has been so successful in the introduction of Camp's underground and interior conduit.

One of the greatest compliments to the widespread influence of the street-railway convention was the appearance, during the entire session, of J. V. E. Titus, secretary of the Garton-Daniels Electric company. Mr. Titus came all the way from Keokuk, Ia.

A little booklet, under the name of the General Electric company, full of valuable information, most tastefully and artistically planned, proved a valuable souvenir. It was rumored, confidentially, that the greater part of the artistic work contained therein was due to A. L. Reich.

C. W. Jefferson, manager of the Schenectady works of the Mica Insulator company, was the man who "did things up brown" for that company. The company made quite an extensive exhibit. A feature was a collection of 55 different types of street-railway motor commutator insulators.

On Wednesday President and General Manager Henry B. Cutter, accompanied by W. H. Scott of the Cutter Electrical and Manufacturing company, appeared and were warmly welcomed. Mr. Cutter may now be looked upon as one of the constant convention attendants, and this time he did not forget to bring Mrs. Cutter.

Mr. S. H. Goddard of the Electrical Review was literally the orator of the occasion at the Phillips clambake just after the street-railway convention. Mr. Goddard did himself proud, and showed that he was eminently fitted to represent a man known as one of the best after-dinner speakers among the electrical fraternity, the proprietor of the Review.

Among the distinguished guests present should be mentioned the names of Thomas Ahearn, vice-president and managing director of the Ottawa Electric railway, and James D. Fraser, secretary and treasurer of the Ottawa Electric Railway company. Messrs. Ahearn and Fraser were accompanied by J. J. Ahearn, foreman of the Ottawa company's car barns.

The Standard Underground Cable company was represented by Mr. G. L. Wiley of New York, Mr. S. E. Hughes of Philadelphia and Mr. F. A. Rinehart. Mrs. Rinehart accompanied Mr. Rinehart and enjoyed herself heartily on the various excursions undertaken for the ladies. The gentlemen named exhibited samples of their fiber, rubber and paper-insulated underground cables.

The Methuen Electrical company exhibited a very unique and new insulator for two-way connectors. It was called a "profit producer," and the saving was evidenced by the ready manner, through its use, that the two-way connectors of the motor leads may be disconnected and again connected without untaping and taping again. This device should be seen and it will be appreciated.

The Adams & Westlake company, Chicago, was represented by F. B. Jones, W. S. Bartholomew, H. E. Keeler and H. E. Stearns. The exhibit consisted of the representation of a street car fitted up with the various Adams & Westlake specialties. Particular mention, however, should be made of the "Acme curtain" and the "contra-twisted double-door hanger." This exhibit attracted a great deal of attention.

Secretary and Treasurer Arthur C. Garrison of the Columbia Incandescent Lamp company arrived at the convention Wednesday morning. Mr. Garrison came straight through from St. Louis, and he told the story, oft repeated, and now most generally believed, as is evinced by the success of his company, "Lamps unequaled in quality." It is said that the Columbia company last month broke all previous records.

Mr. David E. Evans, of that well-known Baltimore railway construction firm, David E. Evans & Co., turned up bright and early Tuesday morning. Mr. Evans is a successful construction contractor and has built up an enviable reputation throughout the territory having Baltimore as a center. His last undertaking, that has been carried out most admirably, is the changing of the systems of the Baltimore Traction company and the City and Suburban railway, so that the two systems are now interlaced, so to speak.

On the ground floor of Exhibition Hall the Safety Third-rail Electric company exhibited Murphy's third-rail system, The exhibition consisted of a most complete model of track and car, with a portion of the track submerged in a water tank, to illustrate the high insulating features of the system. This system, however, has to be investigated thoroughly by personal inspection, to be fully appreciated. It was in charge of Captain Murphy, the inventor of the system, also Mr. G. Kahn Cokeley and Mr. William Devoe. A point to be remem-

[*Continued on page 164.*]

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There was an unusually large attendance of ladies at the Boston convention. Aside from the local committee of ladies, there were fully 200 visitors of the fair sex.

President Lang followed the example of President McCulloch and said a good word for the supply man in his address at the Boston convention. The American Street Railway association deals frankly and cordially with the trade interests at its conventions, and the result is shown in the attendance and interest in the meetings.

One of the papers read at the recent meeting of the American Association for the Advancement of Science (Section D) related to high-speed influence machines and was read by Charles F. Warner of Cambridge, Mass. In X-ray apparatus employing electrostatic machines the latter must be driven at high speed, and the author described special improvements which he has devised to this end. Mr. Warner noted that the causes of the electromotive force in influence machines, their reversals and certain other peculiarities, are not known. His improvements are effected by special insulation, improved contacts, careful balancing of revolving parts and peculiar driving mechanism. The inconvenience from reversals is largely overcome by a newly devised commutator. The principal aim has been to secure high speed with ease and safety. Two forms have resulted—one, designed for compactness, has ball bearings of the highest grade; the other, of larger dimensions, has gear-metal bearings. The speed attained exceeds 4,000 revolutions per minute, which is believed to be the highest rate recorded for influence machines. The resulting discharges are of great frequency, and, for certain purposes, are remarkably efficient.

Chicago will cordially welcome the American Street Railway association to its next yearly gathering, which will take place in this city. The organization has not honored the western metropolis with a visit since the period of its infancy, in 1883. The contrast in street-railway methods of that day and this is startling. There has been almost a complete revolution in the business. Chicago was slow to adopt the improved electrical methods for its surface street railways, but in the application of electrical power on elevated roads it has been a pioneer. It has now, however, electric railways of all kinds, except those operated from sub-surface conductors. The systems of street railroads employing overhead conductors are large and up-to-date; the elevated railroads are all electrically operated and afford a real opportunity for useful study; the suburban lines afford examples of heavy railroading with the use of electric power, and the storage-battery road gives the best opportunity to observe the use of accumulators on the cars to be had anywhere. There are also many special electric-railway applications—in stations and battery substations, on the transmission lines, at drawbridges, in tunnels, on the Union elevated loop and elsewhere—that may well command attention. If the convention delegate cares to look about him in a mood of investigation and inquiry he will find much to instruct him.

The conventions of the American Street Railway association have of late years attracted large numbers of visitors, and Chicago, with its central location, will certainly be no exception. But there will be room and a welcome for all and a place for every manufacturer and supply man to show his wares. It will be strange, indeed, if the next convention of the association be not one of the most successful in its history—especially as we have every reason to believe that the country will be enjoying a season of healthy business activity at the time of the meeting.

Mr. J. T. Hull, the president of the Railway Telegraph Clerks' association of Great Britain, recently sounded a note of alarm in relation to the unfavorable effect of the work of telegraph operators on their health. He went so far as to indicate the "extreme probability" that the vocation of the telegrapher, or telegraphist, as they say in England, was the "most deleterious in its effects upon the operator of any trade or profession hitherto regarded as dangerous." This desperate state of affairs arises, it is argued, from the uninterrupted continuance of nerve stimulation, the monotony of sound and the fixity of attention which are necessary for the mental action of the operator, the work demanding close and arduous attention. "That this condition of concentrated attention," continued Mr. Hull, "is most acutely enervating is the unanimous testimony of all physiologists. During a pressure of work the interference with normal respiration, the increased action of the heart and the rush of blood to the head may be readily observed. These effects are most noticeable during a spell of rapid sending, and are probably due to the physical movements making the attentive effort more onerous." Mr. Hull quoted tables to show the prevalence of consumption among the telegraph operators, and said further that he suspected that many telegraphists "suffer from a modified form of chorea, consisting of a twitching of the fingers in accordance with the telegraphic symbols of the alphabet."

Judging from the experience of American telegraph operators, we think that Mr. Hull rather overstates the case, although it is undoubtedly true that the work of the most expert operators, such as those employed in the newspaper or trade-exchange offices, is most exhausting and makes great demands on the youthful strength of the men and women who essay it. Still the stress of sustained attention is seldom exacted for long periods, and although one must be young and vigorous and alert to be a telegrapher of the first class, we do not believe that telegraphy is the most deleterious to health of all the trades and professions. The crack positions require a constant infusion of new blood and the superseded experts pass to easier positions or engage in other pursuits entirely. This phenomenon of rotation exists in every calling under the sun; but in telegraphy the work cut out for the most proficient and best-paid operators is so exacting that the possible years of top-notch activity are comparatively few. But on escaping from the strain the expert telegrapher should have a fair expectation of life, as is shown by the number of men advanced in years who were active telegraphers in their youth.

It is surprising that our American daily newspapers have not paid more attention to the tragic death of Dr. John Hopkinson, with a son and two daughters, in the Alps. Dr. Hopkinson occupied such a commanding position as a scientist and an engineer, and the manner of his death was so painful and unusual, that one would have thought that the press of all the larger cities would have given some details of his untimely taking off and made appreciative allusion to his work. But the references to the accident in the New York and Chicago papers were of the scantiest description—merely two or three lines announcing the death in the Alps, by accident, of Dr. John Hopkinson, "a celebrated English electrical engineer," his son and two daughters. No American editor seemed to recognize the name as one worthy of honor. How different it would have been had it been a soldier, a politician, an actor, a clergyman or a novelist of equal eminence who had lost his life under such distressing circumstances! The scientific man, unless he makes some startling or skillfully exploited discovery that appeals to the popular fancy, is not, as a rule, widely known in his lifetime; his fame is often posthumous.

From our English technical contemporaries we learn that Dr. Hopkinson was spending a long vacation in Switzerland with his wife and children, with the exception of his older son, who recently left for Colombo. On Saturday, August 27th, in company with his second son, John (aged 18), and two daughters, Alice and Lena (of 23 and 19 years respectively), he set out to make the ascent of the Petite Dent de Veisivi from Arolla. Dr. Hopkinson was an experienced mountain climber. He had devoted his holidays to the pastime for years, and in the neighborhood of Arolla Valley, in particular, had established a considerable reputation among the local guides. His children were also more or less expert climbers, except the younger daughter, and it was to please her that the fatal excursion was undertaken. The ascent was not considered a dangerous one, and the party left the hotel in the morning without guides, but provided with alpenstocks, a rope and a supply of provisions. The climbers should have returned in nine or 10 hours, but they did not, and a search was instituted. The bodies of all four were found roped together at the foot of a moraine. They had fallen over 600 feet from a spot difficult of descent but not considered dangerous. The father and children were evidently returning when, by some unaccountable slip, the catastrophe overtook them.

In the death of Dr. Hopkinson science has lost a penetrating, clear-minded and able investigator and practical engineering a most capable exponent. A brief sketch of the dead man's career has already appeared in the Western Electrician. The electrical men of the United States join with their English colleagues in sorrow and respect.

General Distribution from Central Stations.

PART IV.

Mr. Wagner: Mr. Dow criticized the figures given for feeder drop in the curves showing the distribution efficiency of representative Edison stations. The figures were intended to approximate the conditions existing here in Chicago, and, as Mr. Ferguson has shown by his curves, the efficiency that I gave was higher than he actually finds. I appreciate that there are many Edison stations in which the losses are much less, but the area over which they distribute is very much less, and by limiting the area, or by placing the station in the most central portion of the district to be lighted, it is evident that that loss can be reduced to any degree desired. Considered from the most economical standpoint, the cost of conductors, the cost of real estate and the advantages of location, usually some distance from the center of distribution, where facilities can be found for condensing and for getting coal cheaply, are considerations which must be taken into account, and while it is possible to reduce the distribution losses, as I said, it is not, as a rule, economical to do so, as it necessitates a location which is not in itself economical for station operation.

Mr. Dow asked about the additional resistance in the mains where alternating current is used. All the tables which have been used show this increase in resistance, and they have only taken into account the cables themselves, and not the load on the circuit in connection with the cable loss or the power factor of the load. Were those taken into consideration, and the conductors placed together as near as possible and under one lead sheet, on conductors as large as 300,000 circular mils, which are as large as are generally used for distributing mains, the difference between the alternating current and the direct current is inappreciable. With numerous tests on that size conductor, I have found that the difference in drop with a given current and a power factor of 100 per cent. is about 10 per cent. The actual drop is increased one per cent. with the alternating current. With a power factor as low as 75 per cent., which is as low as any combination of power and light would be on such a system, it is increased to three per cent. additional. The two per cent. drop of the direct current would be increased to 2.3 per cent. The additional cost for alternating mains, three-wire system, would be practically nothing. The figures I gave on the efficiency of alternating enclosed arc lamps, in comparison with the watts consumed for a given amount of light with the alternating and direct current, are correct. They are made from actual experiment, and I can also say that the alternating-current enclosed arcs which we have in use are every bit as satisfactory as any direct-current enclosed arc that I have seen.

Mr. Carnes: Do you use them commercially?

Mr. Wagner: We have about 100 in use commercially. In two months we have changed two lamps out of that hundred. The light is fully as good as the direct current. It is not the standard alternating enclosed arc. It is made specially for a large amount of current, and takes 7½ amperes at 110 volts. In addition to these lamps, we have 3,500 alternating arcs for street lighting and commercial lighting, and they are giving satisfaction. The open alternating arcs for commercial use are operated in connection with armatures especially designed to give smooth waves of current, and there is less noise than in any place I have seen arc lamps in operation. That matter was carefully considered in the designing of the generators. The enclosed alternating arcs are practically noiseless with 60 cycles and the special form of armature referred to. We might have three in this room, and no one would notice the noise.

Mr. Dow also spoke of the increasing use of electric elevators, with motors directly connected to the drum mechanism. I said in my paper that this is the only service that we are not able to render with alternating-current motors. I have, however, since preparing the paper, in the last few days, heard of one installation of six or eight elevators using two-phase alternating-current motors, which were controlled from the elevator in about the same way as direct-current elevators, and directly connected to the driving mechanism and were in satisfactory operation. It is well known that alternating motors can be regulated and the torque increased at slow speeds, by means of suitable resistances. It seems only a question of a short time when this work will be accomplished satisfactorily by alternating two-phase current motors. Single-phase motors have not been tried for that, but a single-phase motor can be controlled in speed in the same way, with a few modifications, that a three-phase motor can be controlled, and I have no doubt that before another year single-phase motors, up to 25 horse power, which is as large as necessary to run elevators, will be used for that purpose.

I want it understood that I do not favor the use of the alternating current in every location and for every application. There are times and places to use the alternating current. Where the distribution is over very small areas, even with the system I have described for short distances, the transformer cost would become a large factor of the cost of the feeder and would probably, for a distance of less than half a mile, exceed the cost of the direct-current feeder. In that case the direct-current feeder is the thing to use, unless the station also furnishes a large amount of current at a great distance, when the use of the several systems would be inadvisable.

Professor Goldborough spoke of the use of sub-stations and cutting off the transformers at times of light load. That could be done in the small stations, but in a system where the distribution efficiency is already slightly over 96 per cent. on the average load, and that is all we have considered, it would seem inadvisable to go to any expense to provide sub-stations or devices for cutting in and cutting out transformers at sub-stations, to increase the efficiency. The cost of the interest on the apparatus involved would decrease the ultimate average efficiency, and, more than that, the cost of sub-feeders from the sub-stations would again increase the first cost of installation, and it would not be economical to have a number of sub-stations; whereas, if the transformers are used, they can be put in any location desired. The iron losses can be reduced to such a very small amount that further refinement seems unnecessary. He also spoke of the power factor, with these transformers at light loads. The power factor, due to the transformer iron losses, could never, with the smallest load you could possibly have in actual service on the transformer, be less than 99.9 per cent., because the iron losses are an incident to the running. It is .23 of one per cent. to the capacity of the transformer. The inductance factor in that one per cent. is practically negligible. Then the use of sub-stations complicates the system; simplicity, without great cost of operation, merits very great consideration.

We operate the open arc light as 50 volts, with cheap American carbon, and they hum and make a good deal of noise, but they are only used for street lighting. We use no series alternating lamps for commercial lighting, even outside of stores, and we do not use them with the underground distribution for house-to-house lighting. We can control them more economically directly from the incandescent system by using a separate system without series arcs. Then, again, the use of the meter for arc lamps is coming into general practice, the same as for incandescent lamps, and, of course, the use of the meter is out of the question for series arc lamps. All central-station men agree that the series arc lamp for commercial lighting will soon be a thing of the past.

The single-phase motors have been pulled to pieces considerably here, but I can say that we have in use over 100 horse power of these motors, the sizes running from one to 15 horse power. The bills are no larger than they were with direct current for the same service. The power factor in motors is between 80 and 90 per cent., according to the size. The highest can be obtained with two-phase and three-phase motors.

Mr. Insull spoke of the system here and the alternating system which was described, and wondered if I would advise changing such a station as the Chicago Edison to a system such as I have described. The question of which system to adopt must be controlled by the existing condition; its economies must be taken into consideration in connection with the cost of the changes and the scrapping of old apparatus. It certainly could not be to the advantage of the Chicago Edison company to make any change in its present system for general distribution from the downtown district here, where the bulk of its lighting is, to any such system as this, if the efficiency was practically 100 per cent. on the average, and I do not wish it to be understood that I would ever advise such a radical change. But in reaching out for new business in outlying districts, it has been proposed by Mr. Ferguson, and is in use in some places, to employ rotary transformers, conveying current to a distance, with high-potential, alternating-current transformers, and re-transforming it to a low potential, and through rotary transformers to direct current. If a system is to be changed and a station which has been operated for some years is to be shut down and it has a large number of direct-current motors and devices to do the work required of the direct-current, involving a large investment, it might not be at all advantageous to change it to an alternating-current station; but for reaching out into new districts and developing them, it seems to me that there would be no reason for using the direct-current rotary transformer. The Brooklyn Edison company has a station which has been in operation some time, where it has installed a large plant some six miles from the center of distribution. It is generating alternating current entirely, three-phase, carrying it to the former centers of distribution and transforming it into direct current. The fact that it is doing it, and the Chicago Edison company is preparing to do the same thing in some instances, shows that there is economy in moving the central station to one side of the district to be lighted, where real estate is cheaper, where water can be obtained for condensing and coal can be had cheaper; and in order to do that in most cities it is necessary to employ alternating current, because the distances obviously become too great for the use of the direct current. Here in Chicago they have accomplished the same thing with the direct current, for the reason that they obtained a location about 3,000 feet from the former center of distribution.

Mr. Insull referred to the fact that the claims of manufacturers several years ago have not been substantiated. The claims were made partly through the ignorance of the manufacturers and partly through the ignorance of the purchasers; but we all know now that the drop in lines, the loss in transformers and the loss in distribution can be very accurately pre-determined. I am not advocating an entirely new system from start to finish. I am basing the system on the Edison system which has been in use for years, and which has been found so successful, and the only change made in that system is the use of alternating current instead of direct current and high-potential feeders instead of low-potential feeders. Our company would not be doing one-quarter the business it is doing to-day if it had been tied down to the direct-current system pure and simple, and it could not possibly perform the service it has to perform to-day with the Edison direct-current system. The amount of business to be obtained in a given area is limited. The area in Chicago served from the Harrison street station is very small compared with the total business to be obtained in Chicago or even in St. Louis, and ours is not by any means as large a city as Chicago, though some of our people think it is. We have to reach out five or six miles in almost every direction to get the business we have. I want to say in answer to some of the statements that have been made, that, in my opinion, it is very undesirable to mix systems of distribution, to use both alternating and direct-current generators in the same or adjacent stations to accomplish the results desired. The multiplication of machinery and the additional investment for the reserve is a very serious factor. I referred to the converter losses in my paper, and I wish to answer Mr. Hubeley on that point. In the most modern transformers made to-day several manufacturers have almost eliminated the fatigue of the iron, and they will guarantee the increase in the iron losses to proceed at a very small rate. I said that in some instances the guaranteee had been made that it would not increase over one per cent. a year, and that where large transformers are used it would be inexpensive to re-anneal the iron of the transformers once in five or 10 years, and that would bring the iron back to its former state.

In connection with Mr. Ferguson's pressure charts I would say that I have seen many pressure charts taken from our lines which would compare very favorably, if not almost identically, with the best one he has shown, and in all cases we use pressure wires. I think that Mr. Ferguson will tell you that in even the best of these alternating-current charts that he showed you no pressure wires were used.

Mr. Ferguson: That is right.

Mr. Wagner: You mentioned that the best chart was taken from a long circuit where a number of transformers were connected to secondary mains.

Mr. Ferguson: There were two feeders running from the station, feeding four large transformers. There were no pressure wires and no feeder compensator.

Mr. Wagner: Mr. Walbank advocated the three-phase system, and I do not want to say anything against it, but where lighting is the principal factor the three-phase distribution cannot be made to regulate as well and give as satisfactory results as the single-phase or direct-current. Mr. Walbank's business, I understand, is principally power. His motor business is greater than his light business, and in all the water-power plants, where the current is furnished principally for power, the lighting is a secondary consideration. It is impossible to regulate satisfactorily with three-phase circuits where the load varies differently on the different phases. The regulator must be placed on each one of the three wires, if it is a three-wire system of distribution, and a regulator must be used to boost up the pressure to compensate for feeder or transformer drop. Any one of these phases affects the adjacent phases practically the same as those you wish to regulate, and it is impossible to avoid this, except by the use of a four-wire system. With a four-wire three-phase system that may be very much lessened, if not eliminated.

What to Expect in North Texas.

[From the Southern Industrial and Lumber Review.]

Some people may think that the proposed line of electric railways to run out of Dallas, especially the one which is to be 40 miles long, to the city of Fort Worth, is an Arabian Night's fairy tale, but such will be mistaken if the usual energy of the Hon. Frank P. Holland is brought to bear in real earnest, as it seems that it will. Such men as Holland and his colleagues, who have been through all kinds of fire in building up the metropolis of North Texas, are just the hot stuff that never dream of turning water upstream permanently, even if they do sidetrack it occasionally. Neither do they waste one iota of their time upon schemes that have not 60 per cent. or more of the first principles of success in them. So let the electrical world look out, for there is likely to be some astonishing developments in North Texas during the dying years of this century.

DEVELOPMENT OF THE TELEPHONE FIELD.

Interconnecting Toll-line Systems.

By H. P. Clausen.

For the purpose of presenting a description of a complete toll-line system that will be readily understood the author has prepared a diagram shown in the cut. This sketch illustrates quite clearly the usual requirements that must be considered and provided for when it is desired to equip an extensive system of toll lines.

Simplicity and uniformity of design should of course receive the first consideration, and if a good commonsense method of construction is adopted, there will be no need of any radical changes. The well-designed system should permit of an unlimited extension, as regards the number of lines served, and such extension, when introduced, should not involve the least alteration in the original design of the system. It is not the author's intention to suggest that a given switchboard need be arranged for receiving more circuits than originally required, but the original board must be supplied with apparatus that will permit efficient interconnecting service, even with the addition of another and perhaps larger section of switchboard. This cannot be accomplished by using the ordinary means of interconnecting employed in connection with switchboards serving individual telephone lines.

The number of connections on a toll-line circuit often averages 10 an hour for each line. Thus while taking care of 10 such lines an operator has almost reached the limit of her probable ability to efficiently serve the interconnections and make the proper records thereof. As the greater part of the toll-switchboard operator's time is taken up with transmitting code signals and making records of effective connections, the switchboard equipment should be designed with a view toward lightening the operator's labors in that direction. The record slips should, of course, be printed, with the blank spaces sufficiently large to avoid cramped writing. The necessary evil of transmitting code signals may be somewhat mitigated by the installation of a constantly driven magneto-generator. Even then, the code signal must be struck off by aid of the ringing button, thus taking up just that much of the operator's time.

There is a solution, however, which the author has in mind, but possibly it has already been applied by someone else. The suggestion is that a set of ordinary adjustable make-and-break wheels be arranged in the normally open generator circuit. The device could be operated by a clockwork or counterweights, as desired. The operator, on receiving an order for a given station, would simply place a single-contact wiper over the proper combination of divided generator contacts, which could be made to correspond with the code signal required for any station in the system. Thus, while the code signal is being transmitted once, or several times in succession, as desired, the operator is preparing the toll checks. On returning to its normal position the wiper would automatically reconnect the operator's receiving circuit to the operator's plug circuit, and thus allow an immediate response from the called subscriber to be heard and acted upon by the operator. Such a device would tend to effect a great saving of time, and at the same time render a uniform signaling service, such as could not be produced with an operator alternately pressing and releasing a push button.

While considering the question of calling a particular station, which may be connected to a given line in common with other stations, it may be well to observe that there is no lack of systems designed for overcoming the objectionable sounding of signals other than that of the desired station. There are, however, few methods which will render a satisfactory service most of the time, instead of "sometimes," as is the case with a large number of the systems produced. At any rate, the manager with only poorly balanced and high-resistance iron-wire toll circuits at his command had better bide his time for the installing of apparatus arranged for a selective signaling service.

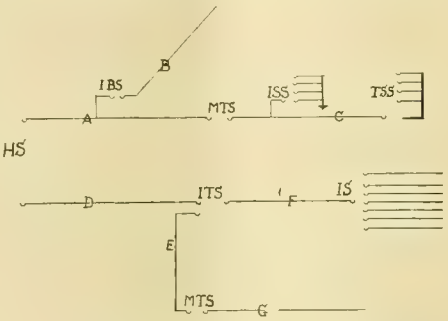
Among the numerous systems produced there is one which is meeting with considerable success. In it the individual station bells are rung by sending out over the line currents of different polarity; that is to say, where two lines A and B are connected to six telephones, the No. 1 telephone is called by passing a plus current over the line wire A and back through the earth to the exchange. The No. 2 telephone is called by passing a minus current over the line wire A and back through the earth to the exchange. The No. 3 telephone is called by passing a plus current out over the B wire and through the earth back to the exchange. The No 4 telephone is called by passing a plus current over the B wire and through the earth back to the exchange. The No. 5 telephone is called by passing a plus current over the A wire back to the exchange over the B wire, and, lastly, the No. 6 telephone is called by passing a minus current over the A wire back to the exchange over the B wire.

The mechanism required in the instrument for rendering the above service is exceedingly simple, but still it requires considerable knowledge on the part of its caretaker to avoid an interruption of service. The American Bell company is employing this arrangement of selective signaling, and it appears to be getting a satisfactory service. Its successful operation, as above stated, depends on the proper care of the apparatus.

Regarding the first application of the above principle for selective signaling, let me quote a passage taken from the report of the National Telephone Exchange association, held in Philadelphia on September 16 and 17, 1884 wherein Mr. A. Berthon of Paris clearly anticipates the above system: "* * * One arrangement is for four subscribers on metallic circuit. We have four keys at the central office, and when we wish to call one subscriber we call him by a positive or negative current sent on one or other of the wires, the wires being grounded at the subscriber's office. That current goes through the ground, positive or negative, on the one wire, and renews the ground at the other end, so that with polarized relays at subscribers' stations we can call the two subscribers branched on the first wire and the two branched on the second wire, which makes four. This is one of the best combinations we have for calling four persons on one circuit, * * * using different polarities of battery to keep the lines, so that one subscriber shall not interfere when the other is talking, and we do it in some instances by throwing the battery on our lines at the very moment when one subscriber is talking. There is a dial that shows whether the line is occupied or not. We throw, automatically, a current on the lines; that same current cuts out the ground, so that the talking is carried on metallic circuit. This same current throws a dial which shows the line busy."

According to Mr. Berthon's description it appears that the French government employed the above system, but Mr. Berthon, who was its chief engineer at that time, thought that the system was rather complicated.

Referring again to the sketch, let us consider H S



INTERCONNECTING TOLL-LINE SYSTEMS.

as the home-station switchboard. I B S represents a tap taken directly off from the main line for the purpose of giving an interconnecting service to subscribers on the branch line B. This station will require a specially designed switchboard, which we may term an intermediate branch switchboard.

At M T S there is installed an operator's, or rather a subscriber's station, for the purpose of calling through to the T S S switchboard when ordered to do so by the home station or intermediate branch-station operator. In our future descriptions we shall term it the main transfer switchboard. At T S S (terminal sub-exchange switchboard) apparatus must be arranged for allowing the successful interconnecting of the local common-return subscriber's circuit with the toll line C and through to the home station H S. It is necessary, of course, that this station should be arranged with repeating coils, etc., which will be described later. At I T S (intermediate terminal switchboard) means must be provided for interconnecting the D, E and F circuits. This station differs from the intermediate branch switchboard in that the E line terminates at M T S, at which point the connection may be extended to the G circuit, whereas at the I B S station the branch line merely gives service to subscribers' telephones.

At I S S (intermediate sub-exchange switchboard) we are obliged to render an interconnecting service from and to the common-return switchboard employing the earth return, as shown by the diagram. Though this switchboard does not differ greatly from the one employed at T S S, it does not connect to the extreme terminal end of the toll line, which is the case at the T S S exchange.

At I S it is necessary to give service to a number of toll-line circuits constructed by another company on differing plans from those of the circuits belonging to the home station H S. Therefore, summing up the different switchboards shown, we have the following: First, home station switchboard; second, main transfer switchboard; third, intermediate transfer switchboard; fourth intermediate switchboard; fifth, intermediate sub-exchange switchboard; sixth, terminal sub-exchange switchboard.

The complete system, with the exception of the intermediate switchboard, is arranged for giving an intermediate service to the following classes of line construction: First, metallic-circuit bridged telephones; second, metallic-circuit series telephones; third, common-wire-return bridged telephones; fourth, earth-return bridged telephones; fifth, common-wire-return series telephones; sixth, earth-return series telephone.

It is the author's intention, while following out the description of the various systems, to leave it entirely optional with the reader as to what system or systems he gives most consideration; that is to say, the metallic-circuit bridged line might be employed as a standard, connecting, however, to the common-wire-return exchanges and ground-return exchanges through the proper appliances, and, if desirable, any of the systems enumerated can be added at any point of the system, and if the general description is closely followed it will be observed that the complete system is in reality a remarkably simple system, considering the possibilities of giving a satisfactory service to a multiplicity of systems.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The report has been published in the Twin City papers that the Northwestern Telephone Exchange company has absorbed all the independent toll-line telephone companies in the state. The local office of the Northwestern claims to know nothing about the deal, saying that it would be effected through the Lowell office. Positive information is scarce on the matter, but there is no doubt that the company has absorbed some of the independent companies. The Haines & Melone system at Rochester, Minn., is one of them, and includes several toll lines to adjacent towns. The Mississippi Valley Telephone company, which has recently come into this field, denies that the reported absorption includes it in any way, and declares that if the Bell interests buy up the independent companies it will promptly parallel them. The Mississippi Valley company expects to have its exchange in Minneapolis in operation by November 1st.

A telephone exchange is in prospect for Belle Plaine, Ia.

The Marshall Telephone company has completed its long-distance line to Boone, Ia., from Marshalltown. The new service will give Marshalltown connection with about 200 new towns west, northwest and southwest.

The Sunset Telephone company is extending its wires from Spokane, Wash., northward, and has reached Springdale.

The E. H. Martin Telephone company of Webster City, Ia., has complete a copper-circuit wire to Marshalltown, Gowrie and other points.

The Chatfield Telephone company of Chatfield, Minn., has completed a metallic circuit to Laird and connects there with the Winona Telephone company's wires.

The council of Great Falls, Mont., has given the Bell Telephone company permission to use the equipment of the Electric City Telephone company, but disclaims all knowledge of the Bell company's right to use the apparatus, and refuses to grant any right not already possessed by the Bell company.

The Stillwater, Minn., exchange has increased its subscribers from 200 to 231 in the last few months.

J. F. Sears of Monticello, Wis., and others propose a telephone line to connect Monroe, Wis., and Blanchardville and intervening points.

The Wisconsin Telephone company has been unable to make long-distance connection with Rhinelander, Wis., owing to the condition of the highway in places between that city and Merrill.

The Moravia Telephone company of Moravia, Ia., has been sold to the Ottumwa Long-distance Telephone company.

Telephony in New Zealand.

In the report of the Post and Telegraph Department of New Zealand for the year 1897, some interesting figures are presented, illustrating the growth of the exchange business in that colony. During the last year 40 subscribers were added to the list, making 5,787 in the colony. Wellington is the principal point, judging from the fact that there are 1,163 subscribers there. Auckland ranks second with 1,039. The receipts of the system were £36,422 6s. 8d., and the expenses and interest on investment £35,008 11s. 5d. The cost of the plant is given at £142,218 11s. 8d. The rate of service is from £5 to £7 per year.

A new multiple switchboard, with provision for 1,500 subscribers and an ultimate capacity for 4,800, has been fitted up in the Wellington exchange. A like equipment for Auckland will be fitted up during the year, and similar switchboards are to be provided for Dunedin and Chirstchurch at an early date.

Notwithstanding that the use of a telephone-exchange connection is restricted to the business of a subscriber or that of his family, employes or guests, it is found that the use of instruments, particularly on long suburban lines, by persons not coming under one or other of these definitions is on the increase. As this affects the revenue derived, the department will probably interfere, as in the case of some of the other colonies—especially Victoria—where it has been found necessary to frame strict regulations to meet similar abuses.

Comparative Earnings and Economy of Operation Between Single and Double-truck Cars for City Use.[1]

By Richard McCulloch.

Part I.

Before beginning a discussion of this subject, it would be well to define what is meant by single and double-truck cars, as these terms are often very loosely used. In this paper a single-truck car will mean one in which the body rests upon a truck the axles of which are parallel with one another and

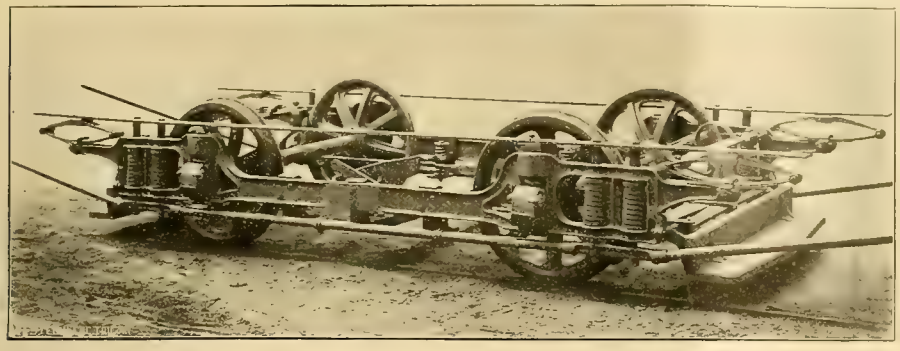


FIG. 1. SINGLE TRUCK.

at all times perpendicular to the center line of the car. In a double-truck car the body is pivoted upon two independent trucks, each of which swings underneath the body with perfect freedom. Fig. 1 is a reproduction of a photograph of an ordinary single truck, and Figs. 2 and 3 show two forms of double trucks.

Double trucks for electric cars are of comparatively recent adoption. All of the early electric cars were equipped with single trucks, and in this horse-car and cable-car practice was followed. As the single truck was first on the ground, and at present largely has possession of the field, it will be assumed that in this case of the "Double Truck versus the Single Truck," the double truck is the plaintiff and must submit the weight of the evidence.

Double trucks were first applied to cars in the desire to use longer bodies than had been customary. In the use of a single truck the best practice has been to limit the wheel base to about seven feet, as a greater distance than this would cause the wheels to bind in curves. Assuming that the body of the car is 20 feet long and that the platforms project four feet beyond the body, the end of the platform would overhang the axle 10½ feet. This is as great an overhang as is customary, although single-truck cars have been built with bodies longer than 20 feet. In this case it is necessary to provide extension springs on the trucks to check the oscillation of the car body. With a very long car body, however, the oscillation is not entirely overcome by this device, and the rocking becomes very disagreeable to passengers and very disastrous to the car and track. Twenty-two feet may be arbitrarily established as the limiting length of the body of a single-truck car, and if we wish to use car bodies longer than this, we must adopt some truck which will avoid oscillation and which will pass around curves without undue use of power. The double truck accomplishes this, and it was to enable longer bodies to be used that it first came into use.

The truck which was first used for long street-railway cars was an adaptation of that used by the

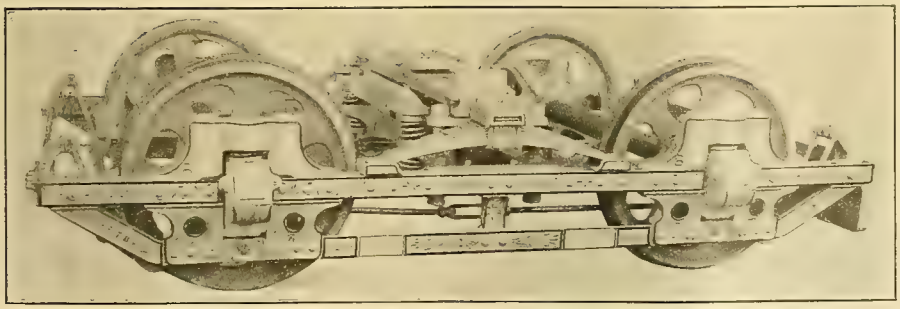


FIG. 3. DOUBLE TRUCK, CENTRALLY PIVOTED.

steam railroads. This truck contains four wheels of equal size and is pivoted over the center. It was soon discovered that for street-railway use this form of truck had two very objectionable features—first, that the floor of the car must be high enough above the rail to allow the wheels to swing freely under the car, and, secondly, the motor being geared to one axle of the truck, only 50 per cent. of the weight of the car was available for traction. The latter is a serious objection on roads having grades.

From what has been said it will appear that the single truck is the truck for short cars and the double truck is the truck for long cars. Therefore, a discussion of the relative merits of these two types of trucks will involve a discussion as to the relative merits of short and long cars. Also, as it is customary to supply long cars with cross seats and short cars with longitudinal seats, we have, instead of the comparatively simple subject of "Single Trucks versus Double Trucks," which has been assigned to your committee, the more complicated struggle between the short car with single trucks and longitudinal seats and the long car with double trucks and cross seats.

It will be assumed in the discussion which follows that the road possesses the characteristic city travel, a load curve of which is shown in Fig. 4. It will be noted that two very pronounced peaks occur in this load curve, one in the morning from six to nine and the other in the evening from five to seven. It is at these times that the capacity of everything is tried. While the load curves of all city roads resemble each other, it is evident that local conditions will, to a large extent, determine the kind of car which the railroad company will operate. Some of these local conditions are the class of people who constitute the passengers, the location of the road with reference to the established lines of travel, the amount of pleasure travel received by the road and the keenness of competition with other roads. The last is an important condition, because a road is sometimes forced to adopt certain measures for its protection which it would not adopt under any other consideration. In this discussion we will assume that it is to the interest of the road, even if no immediate competition exists, to use all reasonable endeavors to please its patrons, because this policy will render the road more ready to meet competition when it arises.

Before the advent of the electric car, the horse car had become such an established institution in this country that certain standards as to track and rolling stock had become fixed. In the matter of rolling stock the size of the car had always been limited by the ability of two horses to draw it. When a mechanical motive power replaced the horses, this limit disappeared, and almost the first improvement made in rolling stock was to increase the size of car bodies. Instead of bodies 16 feet long, electric cars were built with bodies 20 feet long, and now this length is being increased to 28 and 30 feet.

The expense of the average city road may be divided up as follows: Maintenance of way and structures, four per cent.; maintenance of equipment, seven per cent.; conducting transportation, 52 per cent.; general expense, eight per cent.; fixed charges, 29 per cent. It will be noticed that the item "conducting transportation" is more than one-half of the total. This is largely made up of the wages of conductors and motormen and is proportional to the number of cars operated. Hence, it follows that if we may by the operation of larger cars cut down the number of cars, this account may be reduced in nearly the same ratio as the size of the car is increased. There are many other reasons why the size of cars has been increased, such as the increased volume of traffic due to the higher speed and enlarged territory of the street railroads, the greater comfort demanded by the traveling public, the increased power available for the operation of cars, etc., but it is probable that the present tendency toward the increased size of car bodies is with a view of operating larger units and fewer of them.

A line operating small cars seating 28 persons on a headway of 3½ minutes would give the same service from a standpoint of seating capacity if it operated large cars seating 40 persons on a headway of five minutes. Manifestly, this latter service would be preferable from the railroad standpoint, for the reason just given, and the question is, would the service be equally acceptable to the passenger? In this comparison we are assuming that the larger car is the more desirable vehicle in which to ride. Would the pleasure of the ride compensate the passenger for the greater length of time which he would have to wait? This is a question which must be solved by each manager for his particular road, as its correct solution depends largely upon local conditions over which he has no control. The scrutiny with which a passenger chooses a street car varies with the length of his proposed ride. If the ride is to be short, he takes the nearest car without reference to comfort; but if he is to ride a long distance, he will walk past several lines in order to choose that one on which he will have the most pleasant ride. The car question then becomes a more serious one with long roads and with roads catering to a pleasure traffic. It has usually been accepted that on those roads having a purely business traffic, the proper car is the short one operated on short headway. The author, however, is of the opinion that, even in this case, the long car operated upon somewhat longer intervals would be desirable. It has often been observed that where a line operates two sets of cars a passenger will allow several cars to pass him in order to patronize that type of car which suits him best. This has been observed even in the busy hours of night and morning, when it would be fair to assume that passengers would be hurried and likely to take the first car which passes.

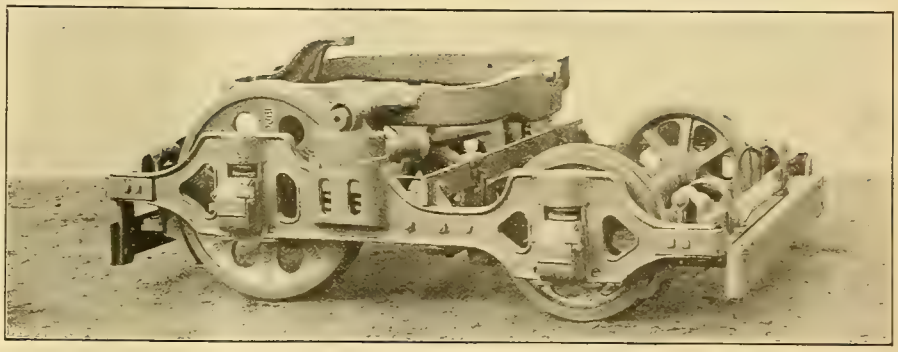


FIG. 2. DOUBLE TRUCK (MAXIMUM TRACTION).

One of the most serious questions occurring in street-railway practice is the problem of how best to take care of the rush of travel which comes morning and evening. With our present methods there are only two ways of taking care of this travel: the first, by increasing the number of cars or units in service, and the second, by increasing the capacity of each unit. The latter method consists of attaching a trailer to the motor car, and where this is done it is usual also to increase the number of units in service. On first thought, there would seem to be no better method of increasing the capacity of a road than by the use of trail cars. They are easily attached and detached; they are in service only when necessary, and they do not require the assistance of additional trainmen. An examination of the trailer system, however, will reveal the fact that it possesses serious defects. The trailer is not automobile and requires the services of men and horses to attach it to the cars and to move it between the car sheds and the motor cars. The opening between the motor and the trail car increases the danger of accident both to passengers and conductors. The number of entrances and exits is increased, and this augments the work of the conductor in keeping track of his fares and increases the danger of his

1. Read before the American Street Railway association, at Boston, September 6, 1898.

passing some of them. If an extra conductor is placed on the trailer to collect fares a great portion of the gain due to the trailer system is lost. The use of trailers throws an additional strain on the motors, as a heavy weight is added to the train

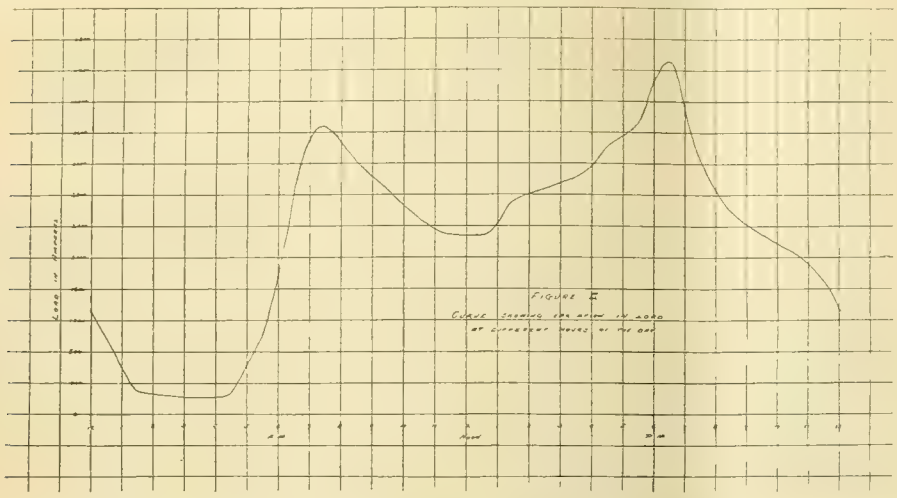


FIG. 4. CHARACTERISTIC LOAD CURVE OF CITY STREET-RAILWAY TRAVEL.

which is not available for traction. The trouble is intensified as the load on the trailer increases; it makes the train more unwieldy in handling, and is largely responsible for the difficulty in starting and stopping quickly and in making schedule time.

To obviate the necessity of using trailers, a large car, equal in seating capacity to the combined capacity of the motor and trail car, may be operated. This system, however, introduces the disadvantage of the operation at all times of the day of a seating capacity needed only during a few hours of the day. It also increases the size and weight of the cars and the average power required to operate them.

In order to compare the relative economies of single and double-truck cars, their advantages and disadvantages will be discussed with reference to the following points:

First—Wear and tear on trucks.
Second—Wear and tear on motors.
Third—Power required.
Fourth—Wear and tear on track.
Fifth—The use of trailers.
Sixth—The seating arrangements and convenience of exit and entrance.
Seventh—The preferences of passengers.

These relations will, as far as possible, be reduced to a money basis, and in order to do so a comparison will be instituted between a road which operates double-truck cars and one operating single-truck cars using trailers 26 per cent. of the time to take care of the heavy night and morning travel.

The bodies of the double-truck cars are 26 feet in length and contain 18 cross seats, seating 36 passengers. The trucks are of the maximum traction type; the empty car weighs 23,500 pounds, and the motors are G E 800. An illustration of this car is shown in Fig. 5.

The single-truck car has a body 20 feet in length; it is equipped with longitudinal seats, and the entire car weighs 16,000 pounds. It will seat 28 passengers. During the period of heavy travel, which amounts to 26 per cent. of the time, trailers are attached to these motor cars. Open trailers are operated in the summer months and closed trailers during the winter. The average seating capacity of the unit, estimating the trailer as a part of the car during the time that it is operated, is 35 seats, which approximates the seating capacity of the double-truck car very closely. The motors in use on the single-truck cars are W. P. 50.

The number of cars operated is obtained by dividing the daily car mileage by 115. It is necessary to do this because the average mileage per car on the two roads is different. The comparison is thus between 70 single-truck cars and 47 double-truck cars, each car making 115 miles per day. The road operating the double-truck cars has the greater density of traffic. The single-truck car with the trailer attached is shown in Fig. 6.

FIG 5 DOUBLE-TRUCK CAR.

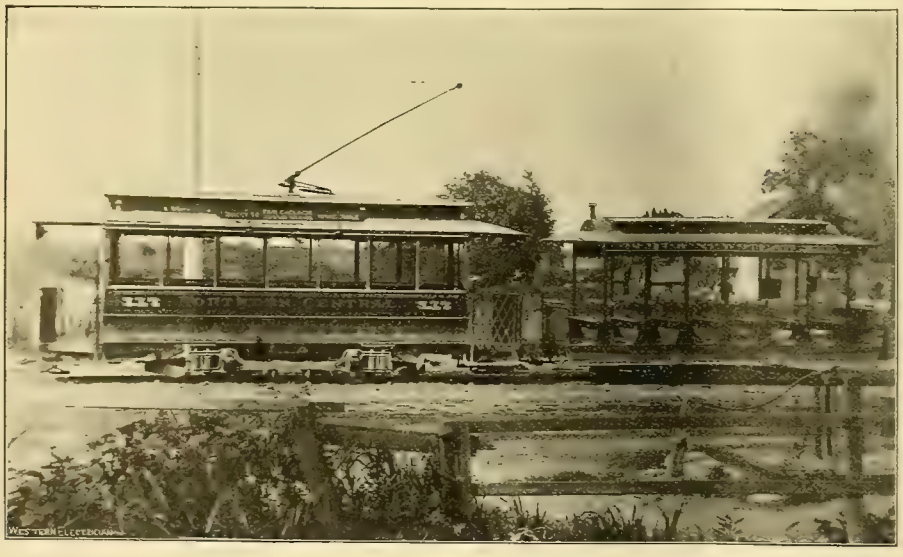


FIG. 6. SINGLE-TRUCK CAR WITH TRAILER.

Exhibits and Exhibitors.

[*Continued from page 159.*]

bered is that a controlling interest in the stock of the Safety Third-rail Electric company has been recently purchased by Emerson McMillin & Co., Wall street, New York city. This system was also shown at the New York state street-railway meeting at Manhattan Beach.

The Baltimore Car Wheel company presented the Lord Baltimore single and center-bearing electric motor truck. Secretary Paul Baker of the company was in attendance. The Baltimore Car Wheel company has for years been to the front in the ranks of manufacturers presenting trucks of the most modern construction, and this truck exhibit showed conclusively that the company realized the exigencies of the business.

The firm of Sumner & Goodwin, the young lady stenographers appointed officially to take care of the convention's needs at Exposition Hall, was indefatigable in its efforts to please all patrons. It also deals in mimeograph supplies, carbon papers, etc., particularly adapted to the high-class needs of the ultra-critical electrical Bostonian, and its office at 724 Chamber of Commerce is one of the busiest spots in the building.

E. R. Harding of Harding & Hammer and the Chicago Rheostat company, Chicago, did the honors for his firm. Mr. Harding presented for the first time a new rheostat. As is well known, Mr. Hammer of the firm of Harding & Hammer was the Hammer that contributed so largely to the success of the old Cutler-Hammer company of Chicago, and his knowledge of the rheostat business has, no doubt, a great deal to do with the fine workmanship displayed by the sample exhibited by Mr. Harding at the street-railway convention.

President Frank N. Phillips of the American Electrical Works found time to steal up to Boston and was present at the exposition hall on Thursday. Mr. Phillips showed great judgment in the selection of the Saturday following the convention as the time for the redoubtable Phillips clambake. This most enjoyable affair is referred to on another page. The guests numbered about 300, which, it is said, exceeds all previous counts.

The Crosby Steam Gauge and Valve company had an exhibit in charge of Robert Perie, manager of the New England sales department, assisted by Charles M. Gibbs. Without going into details of the very extensive and comprehensive exhibit, it may be said that the Crosby company, in addition to exhibiting a full line of its valves, exhibited the Crosby power-station indicators, single-bell chime whistles, and recording steam gauges.

Mr. Macomber of the Leschen-Macomber-Whyte company left Chicago Sunday, joining the party that arrived in Boston over the Hoosac Tunnel route Monday night. Mr. Macomber nobly did the honors and somebody said "stole Convention Whyte's glory." In fact, the only thing necessary to have rounded the Leschen-Macomber-Whyte company's exhibit and make it complete was the sight of that face rarely absent from any convention.

The Edison-Brown Plastic company exhibited the plastic rail bond. It is a "metal putty," which is placed between the rail and angle plate and completes the electrical circuit from one rail to the next. It is held in place by an elastic receptacle of prepared cork, which will accommodate its shape to the movement of the rail ends as cars pass. No amount of hammering or motion can injure the conducting putty or the cork. In the exhibit an angle plate

was shown with contacts and bonds applied 2½ years ago, and used in Staunton, Va., under water during that length of time. The contacts and bonds were bright and all in perfect condition.

The Samson Cordage Works, represented by F. J. Coakley, had a most interesting exhibit just at the entrance of Exhibition Hall. It is safe to say that this company had there represented samples of almost every known variety of cordage. A specialty was made of the Samson spot waterproof cord, so well known for its high quality; also valve cords, valve hooks, etc. The exhibit was strung around with one-inch Samson rope as a railing.

Secretary and Treasurer William M. Smith of the Chicago Insulated Wire company could not resist the temptation to mingle with the convention delegates at Boston, and after his arrival he was daily seen at Exhibition Hall. Mr. Smith has become one of the regular convention delegates, and he is warmly welcomed. He "carries the banner" for a good wire, and his indefatigable efforts have done wonders toward advertising "Chicago Insulated."

Secretary J. S. Speer of the Partridge Carbon company joined forces with Elmer Morris and R. J. Randolph of Sterling arc-lamp fame in devising one of the most unique exhibits in the convention hall. It was a mysterious booth, and legions there were that penetrated its precincts to learn what they could of "X-rays." It certainly was "a winner," and Messrs. Randolph, Speer and Morris are to be congratulated on the success with this unique entertainment.

Of course Manager George C. Bailey of John A. Roebling's Sons company, Chicago, was there in full force. Mr. Bailey left Chicago with the 51 convention delegates that came down over the Wabash, and was daily in attendance at Convention Hall. Someone hinted that Mr. Bailey contemplated entering the ministry, but later this rumor was contradicted, and it was thought to have emanated from a malicious enemy overcome by Mr. Bailey's present beardless appearance.

The Joseph Dixon Crucible company of Jersey City, N. J., was represented by A. L. Haasis, John H. Baird and E. A. St. John, these gentlemen explaining the many interesting facts about "Graphite and Other Things," as manufactured by the Joseph Dixon Crucible company for trolley roads, such as Dixon's graphited wood grease, flake graphite, silica-graphite paint, Dixon's curve and track lubricant, etc. The Dixon company has been remarkably successful with its great variety of lubricating wares, and this convention was no exception.

The Boardman-Tucker company, telephone engineer and manufacturer, 97 Oliver street, Boston, made a most attractive exhibit of railway telephones, attention being called to the company's special railway telephonic apparatus for steam and street-railway service. This company manufactures a full line of wall telephones, a desk set for office use and a special railway telephone for outside use. The latter is fitted in a cast-iron, weather-proof case, similar to the fire-alarm or police box, which can be placed at turnouts or other points. The exhibit was in charge of Mr. Boardman.

The Incandescent Electric Light Manipulator and Cleaner company was represented by Manager Joseph J. Dunn. This company is now located in Hyde Park, Mass., and is making a specialty of the manufacture of a very unique incandescent lamp manipulator and cleaner. This device is for the purpose of unscrewing or cleaning, or, in fact, manipulating in any way, inaccessible incandescent lamps. A most peculiar and valuable feature of this instrument is that a man can hold it perpendicularly and yet unscrew a horizontally placed incandescent lamp. In order, however, to appreciate the full value of this device, it should be seen. A very clear descriptive circular will be sent on application.

The Keystone Electric Instrument company of Philadelphia appeared by its genial and courteous president, J. F. Stevens. Mr. Stevens had secured one of the most desirable spaces in Exhibition Hall, at the head of the main floor. There he erected a large switchboard containing the various high-class instruments that his company is now exploiting. There were presented eight feeder-panel ammeters and a generator panel showing main-circuit voltmeters and ammeters. In addition to this was shown an exhibition board on which were presented one of each of the company's various types of switchboard instruments and a full line of portable volt and ammeters for testing on both direct and alternating current.

The Sterling Arc Lamp company of New York appeared in the person of the general manager of the sales department, R. J. Randolph. Mr. Randolph had secured one of the most prominent spaces in Exhibition Hall and presented a complete line of the Sterling enclosed arc lamps for the following circuits: Series alternating, direct-current constant potential and railway at 500 volts. In addition to the Sterling arc lamps Mr. Randolph was especially interested in the unique "Sterling arc-lamp X-ray exhibit." Ask the visitors to the convention about the "Sterling X-rays" and they will tell you that their penetrating power was, to quote from the language of the enthusiast, "immense." And on Wednesday night one of the most important events of the evening at Exhibition Hall was the "roof-garden" concert, given under the auspices of Messrs. Randolph of the Sterling Arc Lamp company, Speer of the Partridge Carbon company and Elmer P. Morris. This "roof garden" occupied a space over the "X-ray" exhibit and the attractions were a mandolin orchestra that "kept time" with the "X-ray" exhibit.

The Chloride accumulator was exploited by Messrs. Blizard and Clark, representing respectively the East and the West. The company this time made nothing in the way of an exhibition, but the recent very large installations of storage batteries made by the Electric Storage Battery company, both East and West, were enough to create a most decided interest on this subject among street-railway men, and Messrs. Blizard and Clark were able to tell some interesting facts relative to the value of large accumulators in some of the biggest lighting and street-railway plants of this country.

Of course Western Manager Frank Donohoe of the American Electrical Works (Chicago branch) was in attendance. Ten days before the convention Mr. Donohoe left for the East on a combined business and pleasure trip, accompanied by Mrs. Donohoe. He was everywhere welcomed, and with a large coterie of western friends made plans to take in one of the most enjoyable events of the season, the far-famed "Phillips clambake," which took place on Saturday just after the convention. During the mayor's absence from Edgewater the city affairs were left in the hands of his private secretary.

The Central Union Brass company appeared in the presence of its courteous and genial representative, Manager T. C. White of the electrical department. Mr. White made no exhibit and it was a pity, for those who have seen the new street-railway specialties now being exploited by the Central Union Brass company have pronounced them most unique in many ways. Mr. White distributed to some of the intimate friends of his company a very handsome souvenir in the form of a trolley-wire hanger. The demand for these was so great, it is said, there were times when Mr. White had to conceal himself.

President George A. McKinlock of the Central Electric company, Chicago, was visiting Boston at the time of the street-railway convention, and he seized this opportunity to mingle with the large gatherings at Exhibition Hall. From all accounts, the Central Electric company is now doing a most extensive business, especially in the street-railway line. In fact, since the good times began the Central Electric company has really had more than it could well take care of. But the company's strong point is large western stock and quick shipment, and this enviable reputation has been sturdily maintained.

Where was President Joseph Franklin, Jr., of the Commercial Electrical Supply company? If Mr. Franklin had not been on the sick list, it is safe to say that he would have been one of the most warmly welcomed at Boston, had he been able to make the trip. Neither Mr. Franklin nor his lieutenant, Paul D. Cable, could leave St. Louis to take advantage of this large gathering of manufacturers and customers. Mr. Franklin has for several weeks past been slightly under the weather, and this necessitated not only his temporary absence from business, but threw an additional load on Mr. Cable. The fall business, too, of the Commercial company is, as usual, assuming large proportions, and for the above reasons it was necessary to lose the opportunity.

The Wagner Electric Manufacturing company was, as usual, represented by the genial and courteous gentleman known as E. H. Abadie of St. Louis. Mr. Abadie came down to Boston ahead of the convention, in order to arrange the Wagner display, and in the construction of the company's booth he worked in conjunction with Henry M. Nay, the company's Boston representative. The Wagner specialties shown consisted of three different patterns of street-railway illuminated-dial instruments also special switches for 500-volt work. They also exhibited a few transformers. A number of handsome photographs were shown, too, by Messrs, Abadie and Nay, characteristic of the great variety of electrical apparatus manufactured by the Wagner company.

The Bibber-White company's space was located near the center of the exhibit hall, and, being a corner space, is fitted up on two sides by a wall partition covered with a complete assortment of goods of the company's manufacture. On the two outer sides there is a fence, made from posts, with cross-arms complete, with pins and glass insulators attached. The entrance to this space is on the corner, and on each side of the entrance there are two octagon poles and on each pole the company shows a sample of its bracket arms. One bracket arm is called the "double adjustable rigid arm," the other is the "adjustable flexible." Among the goods that are manufactured is a full line of overhead material, car, car-house, station and track supplies. The company also has on exhibition a phonograph, which has 100 different selections. The space is in charge of Mr. Herbert W. Smith, manager of the railway department, and he is assisted by C. E. Bibber, president; E. L. Brown, David Dunn, T. H. Bibber and also the Misses Mendon and Edgell, stenographers. The company gave away a souvenir, which represents its latest thing in a trolley pole. In connection with the Bibber-White company, Robert Fessenden of the Hope Electrical Appliance company was in attendance, pushing the new Hope specialties, which consisted of single and double-pole switches, with a unique quick-break attachment.

The Westinghouse Electric and Manufacturing company of Pittsburg had on hand a large corps of representatives, including Frank H. Taylor, manager of sales department, Pittsburg; L. E. Imlay, N. W. Stover, M. W. Alexander and H. D. Murdoch, Pittsburg; Maurice Coster, Chicago; Charles A. Bragg, Philadelphia; J. R. Gordon, Atlanta, Ga.; F. B. H. Paine, New York; C. C. Frenyear, Buffalo; C. Townley, R. S. Brown and H. M. Southgate, Boston. The exhibit of machinery and appliances was large and diversified, but the most popular attraction of the Westinghouse exhibit was the large sign "The Name of Westinghouse is a Guarantee." This sign consisted of gold letters on glass, and by the aid of high-tension transformers and special apparatus these letters were made to give off miniature lightning flashes, with a steady roar, which made a most unique and dazzling advertising effect.

General Manager Robert F. Carr of the Dearborn Drug and Chemical company's works, Chicago, was in constant attendance, coming down on the train with the Cleveland party. Mr. Carr is now a constant attendant at electrical and street-railway conventions, in the interests of the Dearborn company. This institution, as is well known, is a veritable boiler dispensary, so to speak. In a word, it ferrets out the particular disease with which the boiler may be affected, diagnoses it and prescribes a special remedy to suit each particular case. In this way the science of boiler treatment is reduced to an accuracy which insures the greatest success in the elimination of scale and general purification of boilers. It might almost be called equal to insurance, in that an ounce of preventive is worth many pounds of cure; but the Dearborn company cures as well as prevents, and an investigation of its methods is well worth the while of anyone having a troublesome boiler.

It was a matter of great regret that Treasurer H. K. Gilman of the Western Electrical Supply company of St. Louis could not have seized this splendid opportunity to mingle with the large number of eastern and western manufacturers represented at the Boston street-railway convention. As is now very generally known, the Western Electrical Supply company has been paying during the last few years the closest sort of attention to the building of a magnificent street-railway supply business, and the Boston convention would have been another opportunity during which an increased acquaintanceship could have been obtained. The Western Electrical Supply company recently issued a catalogue that covers most exhaustively the various lines of supply business, and particular attention in this book was given to street-railway supplies. During the last year the Western Supply company has done a remarkably good business and one that seems to be constantly on the increase. In fact, the management of the institution believes that the country has entered upon a new era of prosperity, and is now making plans to even more fully extend its already large business.

The Walker company of Cleveland, O., had the usual large force in attendance. Among those present pushing the company's interests were James Anthony of Cleveland, H. G. Issertel of New York, F. W. Sawyer of Boston, R. A. Burns of Buffalo, J. D. Moore of New York, Charles A. Black of New Haven, M. D. Law of Cleveland, H. G. Gay of Baltimore, J. H. Gates of Chicago, A. T. Moore of Pittsburg, Pa., and M. D. Barr of Cleveland. Among the notable exhibits were switchboards manufactured in the New Haven works, methods and details of armature construction, the latest type of railway motors, including the "15 L" type, such as is purchased and now used exclusively by the Brooklyn Elevated company of New York; also the "20 L," used by the Metropolitan Elevated company of Chicago. An interesting exhibit was the solenoid controller of the Walker company, showing its solenoidal blow-out principles. One of the interesting experiments exhibited by the Walker company in connection with its solenoid blow-out was the placing of a small layer of gun-cotton around the division in the controller and then breaking the circuit at full load and not igniting the gunpowder. Another feature of interest is the "W" conduit for underground work. This is based upon the Love system, although hardly recognizable in its present form. The full section is 50 feet in length, showing all the details. This was inspected by most all the delegates and excited great interest.

The exhibit of the H. W. Johns Manufacturing company in space No. 216 shows a complete line of samples of the railway specialties and supplies manufactured by this company. The Vulcabeston insulating parts for motors and controllers are too well known to need any special description, although a new composition recently placed on the market under this trademark is practically fireproof and possesses insulating qualities said to be superior to anything else yet produced in this line. There is a large sale for the Vulcabeston commutator rings, which are being generally used in railway repair shops. Several styles of car heaters are exhibited, designed for length-wise and cross-seat

cars, and of various types of finish. A special heater, to run singly on 500-volt circuits, is suitable for offices, waiting rooms, etc. Several different lines of overhead materials are shown; also the all-steel bracket arm, which has been having a large sale on account of its combined strength, neatness of appearance and moderate price. The flexible all-steel arm is unique in its design and simpler in construction than the usual span-wire type. There were present at the convention Mr. A. Hall Berry, manager of the electrical department of the company, Mr. J. E. Meek and Mr. S. G. Meek of the New York office, Mr. D. T. Dickson and J. W. Perry of the Philadelphia office, and Mr. E. B. Hatch and H. A. Luscomb of Hartford. Mr. H. C. Spaulding, New England manager of the company, is in charge of the exhibit.

Steam and Trolley Competition at Niagara.

The first recognition that the New York Central and Hudson River Railroad company has given to the competition it has experienced from the electric railways between Buffalo and Niagara Falls and between Buffalo and Lockport has lately been made in a general reduction of rates from Buffalo to the points on the competing lines. The new schedule of rates is as follows:

	One way.	Round trip
Between Buffalo and Tonawanda	20 cents.	30 cents.
Between Buffalo and Niagara Falls	40 "	50 "
Between Buffalo and Suspension Bridge	45 "	60 "
Between Buffalo and Lewiston	60 "	75 "
Between Buffalo and Lockport	50 "	75 "
Between Tonawanda and the Falls	25 "	40 "
Between Tonawanda and the Bridge	30 "	50 "
Between Tonawanda and Lewiston	45 "	60 "
Between Tonawanda and Lockport	30 "	50 "

On Saturdays and Sundays the round-trip rate between Buffalo and Lockport will be reduced to 50 cents. So far the fight between the steam road and the electric roads has not yet reached the stage of a rate war, the intention of the Central being to lower the fare over its lines so as to about equal the fare on the electric cars. The reduction of the rate between Buffalo and the Falls is the most important feature of the new schedule, owing to the enormous traffic between these points. In just one instance does the cut of the Central drop below the price on electric cars, and this is between Buffalo and Lewiston. The round-trip fare between these points has been $1.55 on the Central. Now it is 75 cents, or 25 cents lower than the rate charged by the Buffalo and Niagara Falls road.

Of course the action of the New York Central is intended as a bid for traffic now going over the electric lines. The time occupied by the Central in making the trip from the Falls to Buffalo is from 50 to 60 minutes, while the electric line takes nearly an hour and a half for the run. This time feature is an important item, especially in winter. In passing through Tonawanda the electric cars lose time, not only on account of a limitation of their speed, but also because their route is indirect. Should this be remedied, they would be in better condition to compete with the Central. It is considered highly probable that the Buffalo and Niagara Falls company and the Buffalo and Lockport Railway company will take some action to offset the effect of the cut, and a rate war may result. The effect of this would be noticed more in the vicinity of the Falls and Buffalo should it occur during the busy summer season. As it is now, the season in the Niagara locality is drawing to a close for this year.

When one considers the careful manner in which the great New York Central proceeds to do a thing, it will be recognized that the adoption of these schedules is the most important step yet taken in any locality by a steam railroad to fight the trolley lines. It is a well-known fact that the effect of the competition between steam and electric lines has not been felt in the Niagara locality alone, but so far as known the New York Central is the first steam road to reduce passenger rates to the level of those on competing trolley lines. Another feature is the fact that the electric-railway companies have been able to offer special inducements to the traveling public which the steam roads have found it difficult or impossible to meet, the result being that the electric roads have caught the travel. The New York Central's summer train service from Buffalo to the Falls consists of 16 trains, and 17 trains from the Falls to Buffalo. If traffic warrants it, the company announces that it will put on more trains.

Two Conventions This Week.

As the Western Electrician goes to press two electrical conventions are in progress—that of the Association of Edison Illuminating Companies at Sault Ste. Marie and of the Street Railway Association of the State of New York at Manhattan Beach, near Brooklyn. At the former convention the principal topic of discussion was announced to be "Methods of Charging," and a report from Wilson S. Howell's lamp-testing bureau was expected.

Contract for the construction of the new electric-light plant for the city of Healdsburg, Cal., has been awarded to James Stanley of San Francisco for $31,643.

Stationary Engineers Banqueted in a Machine Shop.

One of the pleasantest features of last week's convention of the National Association of Stationary Engineers at Pittsburg was the excursion and banquet given to the members and friends of the organization by the Westinghouse companies. The afternoon's enjoyment (it was on Wednesday) was planned on a large scale, and the programme of "Westinghouse Day" was successfully carried out. The party was first taken to the works of the Westinghouse Air-brake company at Wilmerding; then the special train was connected, in two sections, to Westinghouse-Baldwin electric locomotives, and drawn over the Turtle Creek Valley branch of the Pennsylvania railroad to East Pittsburg, where the shops of the Westinghouse Electric and Manufacturing company and the Westinghouse Machine company are situated. Here the sightseers were shown over the shops under the direction of Vice-president E. E. Keller and Secretary T. L. Brown of the Westinghouse Machine company. The banquet was served in the erecting room of the Machine company, and places for 600 persons were provided. The Pittsburg Dispatch thus describes it: "The banquet was probably one of the most peculiar in the history of Western Pennsylvania. For 24 hours the Westinghouse Machine company had labored with great cranes to clear the big hall for the event. Outside 50 cars were piled up with the big engines whose places were to be taken by the banqueters. On each side of the hall, 200 feet long by 100 wide, machinery was placed, and when the orchestra came in it could find no place to locate. A happy thought suggested itself and the players were lodged in the big elevator, where, for more than three hours, they played while going up and down with great regularity." The evening passed very pleasantly with the good cheer and the toasts, and it was nearly midnight when the visitors returned to Pittsburg, tired but loud in their praise of the hospitality of the Westinghouse people.

CORRESPONDENCE.

New York Notes.

New York, September 12.—The work of changing the equipment of the Broadway street railroad from cable to the buried-conductor electric system was begun on Friday. All the necessary consents of property owners, state and local authorities having been obtained, President Vreeland issued orders to the engineers of the Metropolitan street railway on Thursday to begin the work, so as to make the work conform with the Fourth, Second and Amsterdam avenue lines. It was intended that this work should be reserved until next year, but the public appreciation of the new system and the fact that the Sixth and Eighth avenue lines have been forced ahead with so much energy induced him to begin the work at this time. The contrast between the comfort of the new electric lines and the jolting discomfort of the cable system, as the Sun remarks, has lately become so apparent that the cable as a means of car propulsion seems almost as much out of date as horse cars were immediately after the cable was installed. Ground was broken opposite the Bowling Green building, on lower Broadway, and will be continued a block or two at a time up Broadway until the most crowded portion is reached, where the company hopes to be able to prosecute the work in the night, when traffic is light and the street is comparatively free of vehicles. The prosecution of the work will not interfere with the operation of the cable cars.

More trouble among the street-railway employes of Brooklyn is reported. It seems that the motormen and conductors on the trolley lines in that city have been complaining for some time about alleged grievances, which, they say, are worse than those which caused the general street-railway strike a few years ago. Among these grievances are violation of the 10-hour law, too many trips per day, the present spotting system, which, they allege, takes away all their independence, and the trip system. Most of the men were afraid to talk lest they might be talking unconsciously to an agent of the company. Some of the employes of the Halsey street, Fulton street and other lines of the Brooklyn City Railroad company said that they were doing a trip more per day on an average than the men had to do before the strike. One man said: "It is very seldom that we can do the trips within the time, and we must do the specified number of trips to get $2 a day. This is universal on all the roads, and motormen have a hard time to make up for any delays that may take place. This makes it hard for the company to get men." The officials of the companies say that the 10-hour law is adhered to as far as is practicable, and that the men are always paid for overtime. The employes of the roads are not organized to any extent. The last strike broke up their organization and they have never been able to reorganize since. Very few cases of accidents have been brought up in the courts for the past year or six months. M. S.

Northwestern Notations.

Minneapolis, September 12.—The annual statement of the General Electric company of Butte, Mont., shows that of the $600,000 capital $25,000 has been paid in in money. The remaining $575,000 is represented in property consisting of an electric-light plant, engines, boilers, dynamos, etc. The cash value of the assets is placed at $611,000. The liabilities consist of first-mortgage bonds amounting to $421,000 and second-mortgage for $3,000. Bills payable are $100,000, and the floating debt is $9,456.

The Farmers' Loan and Trust company of New York has begun suit in Council Bluffs, Ia., against the Council Bluffs Gas and Electric Light company to foreclose a first mortgage of $250,000, on which the interest is alleged to have defaulted. A receiver is also asked for. The suit is said to be a friendly one, and is a step toward reorganizing.

The citizens of Butte, Mont., are inclined to protest against granting a franchise to the Butte Street Railway company to carry freight on all the lines in the city, and will make it hot for any council that grants the right.

Residents of Randolph street, in St. Paul, want the street-railway company to revive the Randolph street car line. It will be necessary to relay the tracks and put the poles and wire in shape. The estimated cost is $15,000.

A representative of an eastern electrical company has been looking over the route of the proposed electric line from La Crosse, Wis., to Black River Falls and Neillsville. It is believed that steps will be taken soon to begin work on the line. The La Crosse and Black River Valley Electric Railway company is to be formed to build and operate the road.

Charles G. Edwards, one of the owners of the electric-light plant in Albert Lea, Minn., has secured a patent on a device for attaching and detaching incandescent lamps.

W. F. Mace of Oshkosh, Wis., is exhibiting an electric gate for railroad crossings and bridges, of his own invention. A company has been formed by Mr. Mace, with his brother, August Mace of Milwaukee, P. C. Henningsen of Lake Mills, Ia., and N. Rasmussen of Oshkosh.

The Twin City Rapid Transit company has proposed to shorten its Oak street line in Minneapolis several blocks, but the patrons at the extreme end are protesting vigorously.

The Fort Wayne Electric corporation has brought suit against J. & W. A. Elliott, Minneapolis contractors, to collect $875. The plaintaiff claims to have furnished electric apparatus for the contractors, which was accepted by the village of Graceville, Minn., as satisfactory. C.

Canadian Intelligence.

Ottawa, September 10.—The new rate of wages put into force by the Ottawa Electric Railway company is as follows: All men who have been employed by the company three years and over will receive 15 cents per hour; those under three years and over two will receive 14 2-7 cents per hour; those under two years and over two months, 14 cents per hour. This schedule only applies to all men at present in the employment of the company. Those employed in future will be graded at 13 cents per hour for the first year, 14 for the second and third years, and 15 cents thereafter. Ten hours are to constitute a day's work.

The Cataract Power company of Hamilton, Ont., formed its first connection with that city last week, sending in 22,000 volts over the wires from its water-power canal near Thorold, Ont., thus demonstrating its ability to convey electrical power a distance of 40 miles. The plant to do this cost about $500,000. A large driving motor of 40 horse power was used in the test, and 200 incandescent lamps which had been arranged in the form of a shield were illuminated. It is expected the company will supply the Hamilton Electric Light and Power company with power for its dynamos by October 1st. The voltage will have to be reduced by transformation to 2,000 before it can be used.

Mr. C. E. Green, who comes from Rochester, N. Y., but who has spent several years in Toronto, Ont., claims to have discovered a mode of producing electricity for light and power purposes without the aid of either fuel or water. He declares that he can produce unlimited quantities at Toronto at a cost to consumers far below one-half that at present involved in the production of electric energy. The secret of this miracle-working is, he says, a very simple affair, but he does not propose to give any clue to it just now. In a few weeks he expects to be able to place the scheme on a working basis.

The Shawinigan Water and Power company, which proposes to utilize Shawinigan Falls on the St. Maurice River, in the province of Quebec, 17 miles from the town of Three Rivers, Que., has decided to install at once a plant capable of developing 100,000 horse power. The plans have been prepared by T. Pringle & Son of Montreal, assisted, as consulting engineer, by Mr. W. C. Johnson of Niagara Falls, N. Y., and the company is now calling for tenders. It is understood that power will be sold at Three Rivers cheaper than it can be obtained at any other port in the world reached by ocean-going vessels, and also at the falls at a proportionately low figure. A strong company has been formed. The company is confident that the advantages which it can offer to manufacturers on a large scale are so great that it will mark an era in the industrial development of the province of Quebec. W.

PERSONAL.

Frank A. Mahoney, formerly of the Chicago office of the Fort Wayne Electric corporation, has taken a factory course at Fort Wayne and will hereafter act as a traveling salesman for his company.

William C. Banks, electrician of the Gordon Battery company of New York, has been in Chicago attending the meeting of the Railway Signal Club, composed of signal engineers, at which the question of batteries was widely discussed.

The Minneapolis correspondent of the Western Electrician states that Morgan Brooks of the Electrical Engineering company, Minneapolis, has been called to the professorship of electrical engineering at the University of Nebraska, located in Lincoln. Mr. Brooks will retain his interest in the Electrical Engineering company.

ELECTRIC LIGHTING.

Fifteen thousand dollars' worth of bonds will be issued for improvements to the city electric-light plant at Ocala, Fla.

An electric-light plant will probably be erected in Dickson, Tenn. The project is in charge of the Business Men's League.

The electric-light plant of the city of Geneva, Switzerland, was burned on September 7th, shutting off light and power from the entire canton. The damage is heavy.

The Los Angeles (Cal.) Times of recent date says that A. G. Croswell, an electrician from San Francisco, has been in Santa Ana working in the interests of a stock company to be organized for the purpose of erecting another electric-light plant in that city. The plant is to cost between $8,000 and $15,000.

L. Beal, R. Moore, J. J. Lewin and Mr. Wood have purchased a controlling interest in the Peninsula Lighting company of Redwood City, Cal. The new owners intend to enlarge the capacity of the plant at once. A new 150 horse power engine and a boiler will be put in, the lines of the company extended and other improvements made.

The reorganization of the Pasadena (Cal.) Electric Light and Power company has been effected. The new directors and officers elected were as follows: President, George H. Barker; vice-president, Henry Fisher; secretary, William R. Staats; treasurer, John B. Miller; attorney, Walter S. Wright; directors, George H. Barker, J. H. Holmes, Henry Fisher, William R. Staats, John S. Cravens, John B. Miller, Walter S. Wright and H. H. Sinclair. The gentlemen named are also the officers and directors of the Edison Electric company of Los Angeles.

ELECTRIC RAILWAYS.

An ordinance has been passed by the council of Oakland, Cal., granting permission to the Oakland Railroad company to use electricity upon its San Pablo avenue line.

A new law regarding the transfer tickets of street-car lines went into effect in New York state on September 1st, providing a penalty for giving away street-railway transfers.

Direct connection by electric road from Rochester to Hilton, a small village four miles south of Manitou, may be realized soon, the directors of the Rochester, Charlotte and Manitou railroad having the project under consideration.

The Northern Traction company has been incorporated with a capital stock of $150.000, to build an electric road between Michigan City and Laporte, Ind. The incorporators are John W. Lovett, W. W. Huffmann, C. W. Hooven and George Nichol.

The Saginaw (Mich.) and Frankenmuth Railway company was recently incorporated with a capital stock of $50,000, to build an electric railroad between Saginaw and Frankenmuth, 14 miles. James B. Peter is president and H. C. Potter treasurer. Both reside in Saginaw.

An interesting item of news comes from Colorado. It is said that the owners of the famous cog road running up Pike's Peak have decided to change the motive power from steam to electricity. It is estimated that the cost of making the change will be about $50,000.

The proposition to convert the present Post, Leavenworth and Tenth street cable line of San Francisco into an electric road, in connection with a line on Montgomery and Sansome streets, is under consideration by the directors of the Market Street Railway company.

The following-named companies were recently chartered to build electric railroads in different parts of Allegheny County, Pa.: Rankin and Hawkins Street Railway company, to build a road one mile long in Rankin township; Edgewood Street Railway company, to build a line about one mile long in Edgewood Borough; Wilkinsburg Connecting Street Railway company, to build a line six-tenths of a mile long in Wilkinsburg Borough; Swissvale Street Railway company, to build a road about one mile long in Swissvale Borough. The board of directors, which is the same for all four companies, is composed of W. E. Guy, president; J. C. Burkhart, William Porter, Edward Williams of Pittsburg, and Harry Fisher of Allegheny.

The Mexican Electric Tramways company has commenced operations. It holds the concessions in the city of Mexico, through the control of the Compania de Ferrocarriles del Distrito Federal de Mexico, with a capital of $20,000,000, Mexican currency. The total length of the roads controlled is about 150 miles. The concessions covering the system run for 99 years from 1883. A large part of the system has been running by horses and is now being changed to electricity, and new electric lines are under way.

A certificate of consolidation of the Buffalo, Tonawanda and Niagara Railroad company and the Tonawanda Electric Railroad company has been filed in the office of the secretary of state of New York. The consolidated road will be known as the Buffalo, Tonawanda and Niagara Falls Electric Railroad company. The capital stock of the new company is $1,500,000, and its directors are Henry B. Smith, H. M. Gillett of Bay City, Mich.; Timothy E. Ellsworth of Lockport; George Sandrock, C. M. Howard and James A. Roberts of Buffalo; James Low, Niagara Falls; J. A. Read and B. L. Rand of North Tonawanda. This road is applying for franchise rights in the city of Niagara Falls, with an idea of becoming a competitor of the Buffalo and Niagara Falls road, better known as the Ely line.

It is reported in the Chicago Tribune that $4,000,000 worth of bonds will probably soon be floated to complete the Northwestern "L" of Chicago. It is said that the bond issue is expected to be taken by a New York banking syndicate at 90, the bonds bearing five per cent. interest. Stockholders of the old Columbia Construction company will also have the privilege of subscribing for the bonds on the same terms with the syndicate that is to take hold of the matter. At the present time only about 51 per cent. of the entire length of the structure has been erected. All the foundations have been completed except between Chicago and North avenues, or about 16 per cent. of the entire line. There are at present in warehouse at Lincoln and Wrightwood avenues the tie-plates and rail-joists necessary for the tracks. The Northwestern "L" will have to be completed by December 31st of this year if forfeiture of the present franchise rights is to be prevented, as the extension of time granted last December was for but one year. It is considered hardly probable that the work can be completed by this time, even if it begins at once, so the council will be probably again asked for more time.

POWER TRANSMISSION.

The syndicate which proposes to put in a water power plant in the Madison canyon, 11 miles from Ennis, Mont., may begin operations soon, according to O. B. Suhr, resident engineer. The plan of the company is to generate electricity to be transmitted to the various mines and mills in Southern Montana, including Butte. Among the promoters of the scheme is L. L. Munn, who is general manager of a similar plant at Telluride, Colo. It is proposed first to build a small plant, furnishing about 1,000 horse power. Later this will be increased to about 10,000 horse power.

LATE PUBLICATIONS.

Cipher code cabling, with its possibilities of condensation and corresponding saving in tolls, has reached such proportions that it has been found worth while to issue a universal cipher code of nearly 150,000 words. The volume is issued by the International Cable Directory company at 30 Broad street, and is called the Western Union Telegraphic Code and International Cable Directory. Besides the code there is a directory giving the cable addresses of leading business firms and individuals in this country and Canada. This is the first publication of its kind in the English language. The cipher feature is obviously not for purposes of secrecy, but for condensation. Many of the words stand for statements which would otherwise require phrases of several words to express. The volume is the largest public code ever printed in English.

The Street Railway Journal for September is entitled to special recognition for its great size and excellent quality. It is in fact a volume of 350 pages —120 pages of "reading matter" (to employ the familiar term, although, of course, everything on and between the covers is intended to be read) and 230 pages of advertisements. It is the "convention issue" in honor of the meeting of the American Street Railway association at Boston, and much attention is devoted to the street-railway interests in and about that city. The magazine is very liberally illustrated with finely executed pictures and is carefully printed on heavy paper. In the advertising pages several skips in the numbering and the polychrome effects in ink and paper are noticeable. One hiatus is from page 28 to page 63, and on these missing pages the index gives the names of a number of European advertisers. The Street Railway Review also issued a handsome convention number, an especial feature of which is a number of small extra illustrations "tipped in" on the pages giving "The Story of Boston."

Powers' American Street Railway Directory for the third quarter of 1898 (the first number) is out, and, so far as revealed by a cursory examination, it seems to have been carefully and conscientiously compiled. It is a companion work to the American Electrical Directory and comprises, mainly, a list of the street-railway companies of the country, their officers, finances and equipment, with tabulated statistics of the whole industry. This is a summary of the latter: "There is reported a total of 1,074 street railways of all kinds now in operation in the United States. Of this number 909 are electric, 21 cable, 31 steam, 113 horse. The total track mileage is given as 16,466.78, of which 14,673.71 is electric, 688.85 horse, 485.68 cable and 618.54 steam. Of the total 48,209 cars given, 32,696 are electric-motor cars, 7,824 trail cars, 2,920 cable cars, 2,882 horse cars and 1,887 are steam cars, the latter including those used on elevated lines." The new directory appears to be a useful work of reference.

MISCELLANEOUS.

The Electrical Club of the Chicago Young Men's Christian Association has issued an attractive booklet outlining its fall and winter programme. There are four courses and three instructors—George A. Damon, T. P. Gaylord and B. H. Glover. The club has acquired considerable laboratory equipment and requests donations of such material.

A French fireman has invented and constructed a powerful fire engine in which the power to propel the vehicle and operate the pumps is supplied by a 30 horse power oil engine. For igniting the charges in the motor cylinders, and also for giving a powerful light on the scene of the operations, a small storage battery is carried, which, when charged, suffices for eight hours' use.

A newspaper paragraph is to the effect that M. Picard has decided upon a new feature of the exhibition of 1900, which is to consist of a gigantic fountain utilizing the hydraulic force of 12,000 horse power required for the machinery of the exhibition. The fountain is to be 34 meters high, and its volume of water over 1,200 liters a second. It will be illuminated by electric lights in every imaginable color.

A communication has been made to the Paris Academy of Sciences by M. E. Branly on the electrical resistance at the contact of two disks of the same metal. The author found that two smooth plane disks of zinc or copper, when pressed together, offer practically no resistance to an electric current under any circumstances. In the case of aluminum, iron and bismuth, however, the resistance, although small when the disks are simply pressed together, is greatly increased when they are forcibly brought together by falling from a height. The author is unable to offer any explanation of these phenomena.

TRADE NEWS.

A. B. Pickett of the Bertha Telephone company of Opelousas, La., has applied for a patent for an improved lightning arrester, arranged to protect telephone instruments and buildings from the effects of high-voltage currents produced by lightning.

The Ludewig-Thurber Manufacturing company of Pittsburg is now at 565 Old avenue. It does all classes of electrical repair work and buys and sells electrical machinery. The officers of the company are: President, J. Ludewig; vice-president, William Ludewig; general manager, J. B. McGinley; secretary and treasurer, G. P. Thurber.

George H. Stout of Cincinnati was in Chicago last week making arrangements for the local selling agency of the Parhelion enclosed arc lamp, of which he is general sales agent. Mr. Stout may well be considered a pioneer, his experience dating back to the organization of the Edison company. Prior to that time he was engaged in the telephone field. He spent five years in England and European countries when the Edison apparatus was first introduced.

For distribution at the Trans-Mississippi Exposition at Omaha the General Electric company issued from its press a neat little brochure, very fully illustrated. As all the machinery used to light the grounds and buildings of the exhibition and to supply the power was furnished by the General Electric company, the types of apparatus shown in the book enable the visitor readily to identify each type as he meets with it in the exhibit or in any part of the working plant itself. Many thousands of these little books have been printed, and the demand for them at the exhibition shows that they are appreciated.

The John A. Roebling's Sons company has entered the rubber-insulated wire field in earnest by the erection of a plant, which was lately put in operation. This company has made a large share of the trolley, feeder, telephone and electric-light wires and power and street-railway cables, together with the less important varieties of electrical conductors, used in the United States. It has also supplied to the trade the Crescent wire, but has not actually manufactured rubber insulation at its own works until recently. Adding this department to the rest has made complete the list of all kinds of electrical

wires manufactured, and the company is now in a position to furnish every electrical conductor of whatever insulation desired. The new factory consists of a building 60 by 100 feet, three stories high, built of brick. It is devoted to rubber insulation alone, containing the best machinery for manipulating the rubber and applying the covering to the wires. The preparation of the wire is carried on in the Roebling wire mills and rolling mills already possessed by the company. The equipment is such that the Roeblings are now turning out a large quantity of rubber-insulated wires for every purpose—house wires, car wires, etc., as well as heavy lead-encased cables for high-tension currents. The quality of the output is sufficiently guaranteed by the name Roebling.

A few years ago a very ordinary incandescent lamp sold for 75 cents, while to-day a much better one can be bought for less than one-third of this price. It would seem as if the manufacturer and jobber, in the days of high-priced lamps, must each have netted a very much larger profit than they do now, when lamps are sold so much cheaper. But, as a matter of fact, it is probable that the actual net profit on each lamp sold to-day is higher for the manufacturer than when he sold his product at a much higher figure, and while the percentage to the dealer is probably quite as high now as then, both the manufacturer and the jobber, in view of the present low price of lamps, must do a greatly increased volume of business to maintain the cash profit of former years. To practically treble a business requires not only push, energy and perseverance, but it necessitates good goods, for no permanent success can be maintained with an inferior product. In the incandescent-lamp field this effort to increase the output of the factories has naturally induced a keen competition, to meet which better facilities for manufacturing economically and well became imperative, and to maintain the standard better material and workmanship became the order of the day, with a net gain to the consumer of a better lamp for less money than ever before. There are to-day a number of good lamps on the market, good both electrically and mechanically, and of various degrees of efficiency, among which may be mentioned the Monarch lamp, which, for a number of years, has been manufactured especially for and under the direct supervision of the Western Electrical Supply company of St. Louis, Mo., and which is well and favorably known to the electrical fraternity.

BUSINESS.

The Goulds Manufacturing company of Seneca Falls, N. Y. (22 and 24 North Canal street, Chicago), has issued two "partial catalogues"—one of triplex electric pumps and the other of power pumps generally. Both are sent on application.

The Peerless Rubber Manufacturing company of 16 Warren street, New York, is distributing a large colored picture of the Oregon. A copy will be sent free to any engineer on application. On the Oregon's voyage around the Horn the machinery was fitted with Rainbow and Peerless packings and Eclipse gaskets.

The Mason Telephone Pay Station company, Ludington, Mich., states that the demand for its automatic telephone pay station is growing every day and that it now has plenty of orders on hand. The company states that it has not had a single automatic pay station returned to it, and that a great many independent exchanges are using the apparatus.

The Electric Appliance company has just printed a special catalogue devoted exclusively to Anchor switches. This catalogue is fully up to date, embodying all the recent improvements that have been made in snap switches. The catalogue is supplied with a special discount sheet to the trade, and altogether it makes a valuable little reference book on switches. It can be had for the asking.

In a recent letter to the Westinghouse Electric and Manufacturing company, Mr. Horace E. Andrews, president of the Cleveland Electric Railway company, Cleveland, O., states: "We are delighted with the operation of the No. 49 motors, and are having better success with them than with any other motors we have ever operated." This motor embodies all of the best features of previous types of Westinghouse motors, which have an established reputation.

The Beacon Lamp company of New Brunswick, N. J., has been making some satisfactory tests on its lamps, with a view to bringing out the fact that they will retain their initial candle power for a large number of hours. The lamp is claimed to retain its initial candle power for over 300 hours, and the company also claims that, after 300 hours' burning, the lamps give more light and use less current than when started, and show no blackening. The Beacon company makes lamps of from 2.75 watts per candle upward, the standard efficiency being 3.5 watts.

Beaman & Smith of Providence, R. I., are erecting a new machine shop 60 feet wide and 130 feet long, with lean-to addition 20 feet by 50 feet. The construction will be modern in every respect. It will have a maximum amount of light consistent with good construction, will be practically fireproof and will be arranged with traveling cranes, trolleys and such appliances for easy handling of materials and machines. The entire building was designed by, and the steel work is being furnished and erected by, the Berlin Iron Bridge company of East Berlin, Conn.

The Western Electric company has recently issued a neat 40-page pocket catalogue of linemen's construction tools. A large supply of tools is always carried in stock, and orders can be filled promptly. If any of the readers of this paper have not received this catalogue a copy will be mailed upon request. The long-burning W. E. Petite enclosed arc lamp manufactured by the Western Electric company is now made in three styles—plain and ornamental, with porcelain shades and with metal shades for factory and outdoor use. The company recently issued Bulletin No. 7-RS, giving detailed description of the Russell & Officer automatic switch. The object of this switch is to allow the turning on or off of one or any number of lights from two or more points by means of push-buttons.

ILLUSTRATED ELECTRICAL PATENT RECORD.

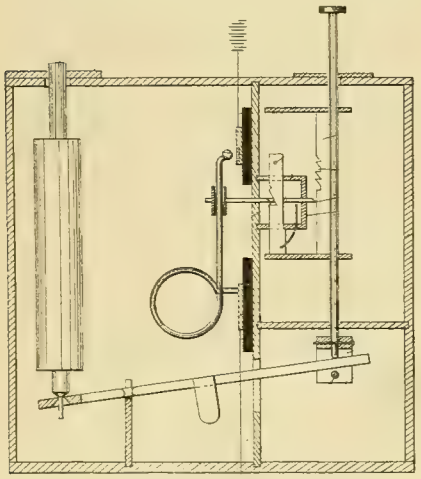
Issued September 6, 1898.

610,190. Secondary Battery. George J. Miller, Kenton, Ohio. Application filed April 13, 1897.

In a secondary battery the combination of an insulating box, positive and negative electrodes within the box composed of active materials mounted within and in conductive connection to a perforated metallic lead case, a surrounding space between the active material and the surrounding case except where attached, means for preserving the space, and means for connecting conducting feed and discharge wires.

610,197. Controlling Device for Electric Elevators. Norton P. Otis and Rudolph C. Smith, Yonkers, N. Y. Application filed April 4, 1892.

Two circuit terminals are provided, one to control a circuit for operating the mechanism to elevate the car and the other to lower it, a push button at the landing, an automatic switch actuated by the car and governing the contacts, and means for holding the switch in an intermediate position when the car is opposite a landing.



NO. 610,278.

610,229. Electric Clock Train. Charles M. Crook, Elgin, Ill. Application filed April 29, 1897.

One claim is given: In a clock movement, in a combination with a motor such as a mainspring, the principal train actuated thereby extending to and including the seconds hand, a secondary or offshoot train actuated by frictional connection with the principal train, such offshoot leading to and comprising an escape wheel, a synchronizing device adapted to act upon a wheel in the principal train positively connected with the seconds hand staff, and means for operating the synchronizing device.

610,274. Telautograph. Leon O. McPherson, Highland Park, Ill. Application filed March 13, 1897.

Included in this arrangement are a receiving pen, electrical means for imparting the movements of progression thereto, a paper-shifting mechanism including a shifting roller, a commutator mounted on each end thereof, one of the commutators arranged to control the circuit of the paper-shifting mechanism and the other to control the circuit of the means for imparting the movements of progression to the pen.

610,278. Telegram Transmitter. Edward Porter, Sydney, New South Wales. Application filed September 4, 1897.

There is the combination with a slidable key having a code plate, of a slide having an operative connection with the code plate during its downward movement, a circuit make and break device operated by the slide, a slidably mounted stop plate having a contact with the slide upon the return movement of the key, the stop plate serving to retain the slide in a fixed inoperative position, and means, connected with the key, for moving the stop plate at the end of movement of the key.

610,339. Telegraph Tape. Frank Atherton, Paterson, N. J. Application filed November 12, 1897.

A light-colored coil or roll of telegraph tape has its inner convolutions glued or pasted together to form a bushing, the tape having the marginal portions only of one or both of its surfaces colored for a specified distance and near the free end of the inner convolutions of the coil or roll, in contrast with the remaining portions of the surfaces.

610,347. Telephone. William A. Drysdale, Philadelphia, Pa. Application filed September 17, 1897.

In a telephone station there is the combination with a converter having secondary and subdivided primary coils, which form part of the talking circuit, and are distinct from the receiving instrument, of line connections for the secondary coils, current supply connections for the primary coils, and manually operative means to continuously reverse the primary connections.

610,393. Telephone. Sydney S. Fisher, San Francisco, Cal. Application filed January 14, 1897.

Two stations are connected by a line wire whose ends are in electric connection with switch points, each station having a grounded instrument circuit terminating in a contact point, a grounded signaling circuit terminating in a contact point and embracing a main battery and a relay wound to a resistance adapted to the line-wire circuit, a local circuit embracing a contact point, the armature of the relay, a local battery and a signal, and a normally open ringing-up circuit leading from the grounded signaling circuit, terminating in a contact point and containing a circuit closer, the three contact points of the instrument, signaling and ringing-up circuits lying within the path of movement of the switch points.

610,402. Electric Switch. Rudolf L. L. Hundhausen, Wilmersdorf, Germany. Application filed December 31, 1897. Patented in Germany October 12, 1895.

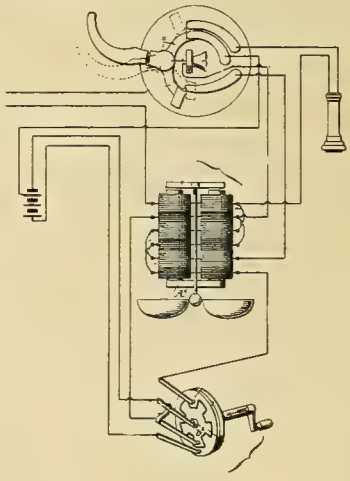
Claim is made for the combination with the movable contact part of a switch terminal or terminals with which it is adapted to close circuit, an actuating part provided with inclined faces associated with the contact and a spring connected with contact adapted to be placed under tension upon each movement of the contact part, whereby the controlled circuit is suddenly opened or closed upon the rotation of the actuating part.

610,406. Resistance and Contact Apparatus for Electric Currents. Henry Lyon, Glasgow, Scotland. Application filed July 6, 1898.

The combination is described comprising two or more pairs of jars, each jar being partly filled with a resistance liquid and having at the bottom a metal cup conducted to a main conductor, also a horizontal shaft extending above the jars and along midway between the individual jars of the several pairs, the shaft having on it pulleys, one for each pair of jars, also suspended from each side of each pulley a metal cone which, by the turning of the pulley, descends or rises in each jar, the cones being connected to separate conductors, also a handle fitted to each pulley with means for fixing and loosening the pulley on the shaft, and also means for turning the shaft and thereby simultaneously turning all the pulleys on the shaft, or as many as are fixed thereon.

610,413. Direct-current Regulator. Frederick E. Ramsay, Walsenburg, Colo. Application filed January 28, 1898.

In a portable direct-current regulator there is the combination with a pair of insulating disks and a socket and tap extending oppositely from the disks of a resistance circuit, spirally arranged upon one of the disks, a series of contact plates constituting portions of the resistance circuit, one of the plates being in direct electrical connection with one of the terminals of the socket, and a longitudinally movable switch rod in electrical connection with one of the terminals of the tap and designed to make electrical connection with either of the contact plates in resistance circuit.



NO. 610,347.

610,445. Electric Railroad. John C. Henry, Denver, Colo. Application filed June 30, 1898.

A method of accelerating electric motors which are ordinarily independently excited consists of starting with the armature and field magnets in series and gradually decreasing the motors' resistance by changing them to independently excited machines.

610,509. Means for Controlling Voltage and Volume of Electrical Currents. Harry Williams, Cleveland, Ohio. Application filed December 8, 1897.

In an apparatus for controlling the voltage and volume of an electrical current, a series of cells and a series of resistances arranged consecutively and connected together, a series of contact points for the cells and the resistances and a series of resistances outside of the cells and on the circuit and a switch.

Western Electrician.
EVERY SATURDAY.
Vol. XXIII. CHICAGO, SEPTEMBER 24, 1898. No. 13

Westinghouse Apparatus at Omaha.

The exhibit of the apparatus manufactured by the Westinghouse Electric Manufacturing company at the Omaha exposition is situated in the northeast section of the Machinery and Electrical Building. The exhibit occupies nearly 3,000 square feet, and is a source of continual interest to all engineers and other visitors to the exposition. In the center is a 1,000 horse power, 10-pole, 625-volt power generator, arranged for direct connection and to be operated at a speed of 115 revolutions per minute. This dynamo is one of the Westinghouse company's standard machines, and weighs without shaft 55 tons. It certainly presents a very imposing appearance and attracts a large amount of attention.

Facing the north aisle is a 300-kilowatt street-railroad booster set. The motor is compound-wound and has a capacity of 480 amperes at 625 volts. The generator is series-wound and has a capacity of 1,000 amperes at 300 volts. This set is designed to operate at 500 revolutions per minute.

The exhibit is lighted by current supplied from a 75-kilowatt two-phase generator of 2,200 volts, belt-driven by a 300 horse power generator operated as a motor. These machines are of standard design. The alternator fields are excited from a 7½ horse power dynamo wound for 125 volts, which is direct-connected to a 7½ horse power 500-volt motor.

The exhibit of type C induction motors, ranging from 100 horse power to 3½ horse power, is a brilliant illustration of the progress in alternating-current power transmission, and appears in striking contrast to Tesla's experimental apparatus, which is exhibited alongside of it.

Very interesting are the experiments with the Holtz machine, demonstrating the resistance to the passage of disruptive discharges through lightning arresters, and also showing the protective power of the Wurts non-arcing arresters against lightning. A number of these arresters are on exhibition, including a tank arrester, railway arrester and a bank of arresters mounted on marble panels, designed for a 33,000-volt transmission line.

The arc lamps are carried on 10 ornamental iron posts and consists of alternating-current and direct-current long-burning lamps (150 hours) and other types as manufactured by the Westinghouse company.

Great interest is shown in the apparatus used to obtain the high-potential discharges. The current is taken at 2,200 volts from the 75-kilowatt alternator and transformed down to 250 volts. This in turn is sent through a special oil-insulated static transformer, and raised to 60,000 volts. This transformer is of great interest to engineers, and, when taken in connection with a full line of smaller transformers, this type of apparatus is well represented. The apparatus used in connection to obtain this discharge is an arrangement of three glass plates 60 by 30 by ⅜ inches secured in a suitable frame, upon the front of which are mounted copper letters arranged to give the information that "The name of Westinghouse is a guarantee." These letters are connected to one side of the circuit; the other side of the circuit is connected to tin-foil placed on the opposite side of the glass plates. The discharge of this exceedingly high-potential current takes place over the face of the glass with startling effects.

Many photographs of the various departments of the Westinghouse company's works are shown, also of the Niagara and other plants, showing the company's machines. These photographs give a very good idea of the company's products, and add materially to the exhibit.

Several street-car motors of the latest type, together with controllers, diverters, etc., are of especial interest to those interested in street-railroad work. The 17-panel standard street-railway switchboard, built for controlling four 750-kilowatt generators and three 300-kilowatt booster sets, is of white Italian marble, and has four generator panels, three booster panels, two load panels and eight panels for feeders, with all the necessary instruments and switches for handling 7,000 horse power.

The illuminated sign makes a striking display. It is operated by a revolving switch, which is driven by a 3½ horse power 125-volt motor, the current being obtained from the direct-connected generator used to excite the fields of the alternator. This sign contains 486 eight candle power lamps, and is 16 by six feet in size. The lamps form the words "Westinghouse Electric," the arrangement and shading of the letters being beautifully executed. The effect is very fine.

Among the display of details which are exhibited by the company are different sizes of plunger, washer and quick-break switches, an assortment of circuit breakers, integrating wattmeters, ampere-hour meters, voltmeters and ammeters, rheostats, starting boxes; in fact, an interesting collection of the general supplies manufactured by the Westinghouse company. It is conceded that this exhibit is one of the finest and most complete on the grounds, and the continuous crowds around the space seem to justify the assertion that it is the most interesting.

WESTINGHOUSE APPARATUS AT OMAHA.

Property owners of San Gabriel and Alhambra, Cal., will raise $20,000 as a bonus to be paid to the Los Angeles Terminal Railway company to secure the construction of an electric line four miles long from South Pasadena to San Gabriel Sanitarium, passing the San Gabriel Mission and Alhambra. At a previous meeting of the citizens of these towns the railway company made a proposition to them, that if the $20,000 bonus was raised it would assure them of the construction of the line desired and would promise a 30-minute service, the fare for the round trip to and from Los Angeles to be 35 cents.

Electric Lighthouses.

The numerous advantages of electricity over other illuminants for lighthouses and searchlights have long been acknowledged. For lighthouse purposes, too, the electric arc has been used successfully for several years on the shores of England and France.

There are two general forms of illumination known to the lighthouse boards, aside from the steady, constant beam of the less important stations. These two forms are essentially different only in what might be called time punctuation. One is known as a flash light, which flashes at regular intervals, while the second has one or more periods of light, with total or partial darkness intervening. This again is sometimes varied by the intervention of colored rays. The latter form is less valuable where the light is expected to be seen from a long distance, for the

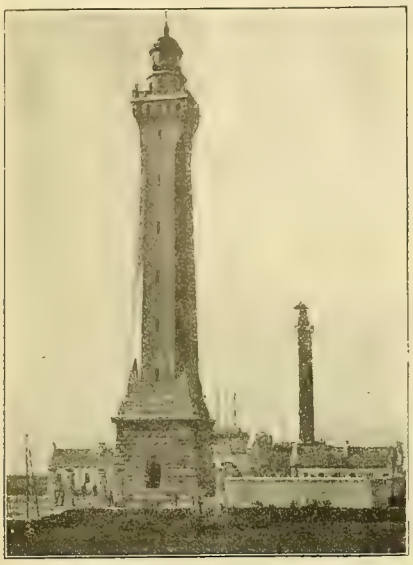


FIG. 1. ELECTRIC LIGHTHOUSES.—THE ECKMÜHL LIGHTHOUSE AT PENMARCH.

colored beams are not nearly as far-reaching as the white ones.

These various periods of light and darkness are regulated by machinery, and the charts give navigators a positive knowledge of their whereabouts, something after this manner, the illumination alternately increasing and decreasing: "Light on Cathead Reef: Light two seconds, dark three seconds, light four seconds, dark six seconds; 16 miles N. N. W. of Prince Point Harbor," etc.

One complete revolution of the machinery gives the above results, which are constantly repeated. Sometimes, as stated, colors are used to give greatly increased variety, on inland waters, but on the ocean coasts colors are seldom used.

To show the distance at which it is possible to see and recognize a powerful light, that of La Hève, France, which has an illumination nearly equal to 24,000,000 standard candles, and is visible about 23 miles away for 11 months in the year, may be mentioned. The light which was replaced by the present one was only at its best from seven to eight months of the year.

An improvement on this system has been adopted with an interval of darkness between each group of two flashes.

The movement is effected by a small electric motor, direct-connected, being wound upon the shaft of the apparatus and thus making an equal number of revolutions with it. The electrical energy required to impart to the moving parts six revolutions per minute is about 50 milliamperes at a pressure of three volts, developed by a battery of four elements in series, mounted in the base of the lantern. The electromotive force generated is about 5.8 volts, but this is cut down by a regulator. The battery has a life of two to three months without supervision—a very marked advantage for lights in isolated positions, on rocky islands, etc., where habitation is impossible. The apparatus at Ville-ès-Martin is illustrated in Fig. 3.

Returning now to the Eckmühl light (Fig. 1), named for the son of the first prince of the name, it is to be noted that the light is placed on a tower 63 meters above the ground, and that the focal plane of the rays is 64 meters above the water level at full tide. The interior of the tower contains the engine and dynamo rooms and living apartments for attendants. Outside is the semaphore station upon a rock base, for convenience in signaling passing vessels.

Two engines drive the two dynamos (Fig. 2) and an air compressor for a siren. The alternators are two-phase, of two kilowatts at 69 volts pressure. They are excited by a couple of small dynamos mounted on the same shaft. The alternators have eight poles each. The intensity of the field is about 4,000 units C. G. S., and the resistance of each circuit is about 0.213 ohm. The speed varies between 810 and 820 revolutions per minute, with an efficiency of 70 to 75 per cent., according to load.

The reason for adopting two-phase apparatus is found in the double optical plant, each half of which is said to require a distinct source of current.

The luminous power of the Penmarch (Eckmühl) plant is immense, thanks to the peculiar arrangement of the optical apparatus. It is not by doubling the electrical energy that one arrives at a doubling of the light effect; for example, 25 amperes at 45 volts give in other lanterns an intensity of 1,200,000 carcels (a carcel is from 9.5 to 9.6 standard candles), but 50 amperes will give here but 1,800,000. Yet, on the contrary, with double optical apparatus, an intensity of 50 amperes for each source will give a total of 3,600,000 carcels, and with the same current—100 amperes—in a single lamp only 2,300,000 carcels would be attained.

The idea of the double optical arrangement was a result of the Eiffel tower experiments. The oscillation of the lights, because of the tendency of the carbon craters to burn obliquely, with 50 amperes of current in each lamp, is compensated for by the peculiar arrangement of double reflectors, so that one of these is constantly reflecting the maximum of rays, while the other is reflecting the minimum; and, of course, when one of these changes the other does also. A table shows the variation as well as the mean illumination in bougies or candles:

Carbons.	Minimum bougies.	Maximum bougies.	Mean bougies.
10 millimeters	20,000,000	26,600 000	23 200,000
16 millimeters	30,000,000	40,000,000	35,000 000

The Penmarch light is visible in clear weather at a distance of 60 miles, and at least 25 to 30 miles in thicker weather, and of course less in a dense fog. But it is greatly in advance of the old lights, which were absolutely valueless when even a light fog came down upon these inhospitable and dangerous coasts.

The structure in which this lantern is placed cost 400,000 francs, the electrical portion 125,000 francs,

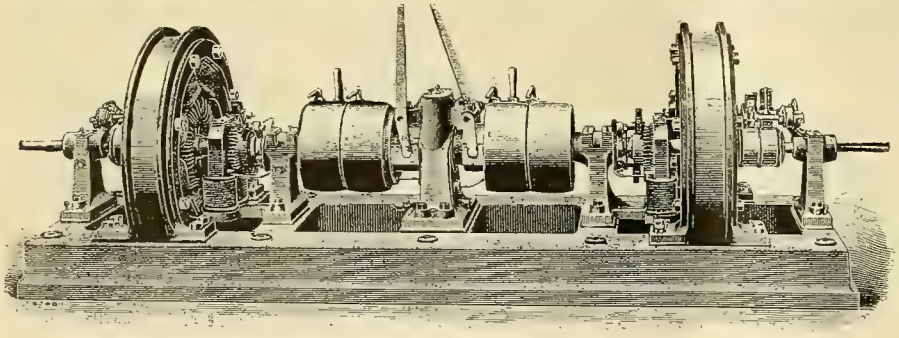


FIG. 2. ELECTRIC LIGHTHOUSES.—TWO-PHASE ALTERNATORS IN THE ECKMÜHL LIGHTHOUSE.

in the apparatus for the lighthouse of Eckmühl, consisting in connecting two optical combinations of four lenses, their axes parallel in pairs, the whole rotating around a common center. This arrangement doubles the intensity of the light. The double apparatus has four lenses made of six dioptric and 10 catadoptric elements, as against five dioptric elements at La Hève, the focal length remaining the same. The optical apparatus of this huge combination weighs about 4,000 pounds, and is mounted upon a platform turning upon an arbor to which is fixed a drum running in mercury. The motive power is simple clockwork.

The lighthouse on the rocks of Ville-ès-Martin, near Saint-Nazaire, illuminates the surroundings for one-tenth of a second, and is extinct two seconds, the sweet-voiced siren 30,000 francs and the setting 25,000 francs, making a total of 580,000 francs. The yearly cost of maintenance is 25,000 francs, and the personnel of the lighthouse includes six men.

France now has a list of 13 electrically illuminated lighthouses, five of which have a uniform single flash or illumination, six have two, and two have four varying periods. These are all of the first order, and comprise over 15 per cent. of the total lanterns of that grade.

The facts and illustrations are from l'Electricien.

The village of St. Joseph, Ill., will put in a municipal light plant. J. D. Wallace of Champaign, Ill., is the constructing engineer.

Power Consumed by Wood-working Machinery.

Professor O. G. Dodge, U. S. N., who was chief electrical inspector at the World's Fair, recently made some careful tests to determine the power required to drive wood-working machinery at the navy yard in Washington. With a circular rip-saw 28 inches in diameter and running at 1,200 revolutions a minute (or 8,800 lineal feet per minute), and ripping seasoned hard oak 7⅝ inches thick,

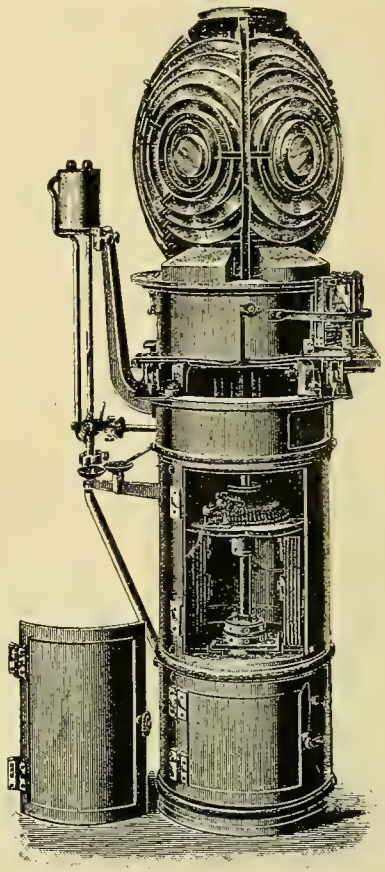


FIG. 3. ELECTRIC LIGHTHOUSES.—ELECTRIC APPARATUS AT VILLE-ÈS-MARTIN.

with a feed of 10 feet a minute, 18.8 mechanical horse power was used (the figures are given in the Railroad Gazette). The motor and saw running idle absorbed 2.1 horse power. In other tests with ripsaws of 24, 14 and 12 inches diameter and at varying speeds of from 1,500 to 2,000 revolutions a minute, the mechanical horse power output ranged from 2.6 to 8.9 horse power.

A band-saw running at 160 revolutions a minute (or 3,017 lineal feet a minute) required 10.4 mechanical horse power when the motor was running idle. When ripping seasoned ash 10¾ inches thick with a feed of six feet a minute, but 14.8 horse power was consumed. In ripping yellow pine 12 inches thick and running 20 feet a minute, 17.6 horse power was consumed.

The above figures are in contrast with the work done by a band-saw having a pulley 28 inches in diameter and running at 480 revolutions a minute. With a belt pulley 12 inches in diameter and 3½-inch face and with the motor belted to the saw shaft the motor consumed nine-tenths horse power when running idle, and but 1.3 horse power when ripping seasoned oak three inches thick and with a speed in one case of 2½ feet a minute, and in the other cases of four feet a minute, the difference in speed apparently making no difference in the consumption of power.

Tests were also made with motors driving boring machines. With a speed of the bit running at 375 revolutions a minute, with the motor belted to the bit shaft and running idle, 0.5 horse power output was required. When boring four-inch holes in seasoned oak at the rate of 9 3-5 feet a minute, 1.2 mechanical horse power was consumed. Similar tests running at a speed of about 750 revolutions a minute and boring holes of various thickness, showed about the same ratio of power consumed when the motor was running idle, compared with the power consumed as in the above case.

It is rumored that the Chicago City Railway company is negotiating or has concluded the purchase of the Alley "L" property belonging to the South Side Elevated Railroad company of Chicago. This road is operated successfully on the Sprague multiple-unit electrical system, and its stock has advanced 15 points in the last three weeks. It is reported that the Chicago City people will assume the $750,000 of bonded indebtedness on the Alley "L" and guarantee four per cent. on the stock.

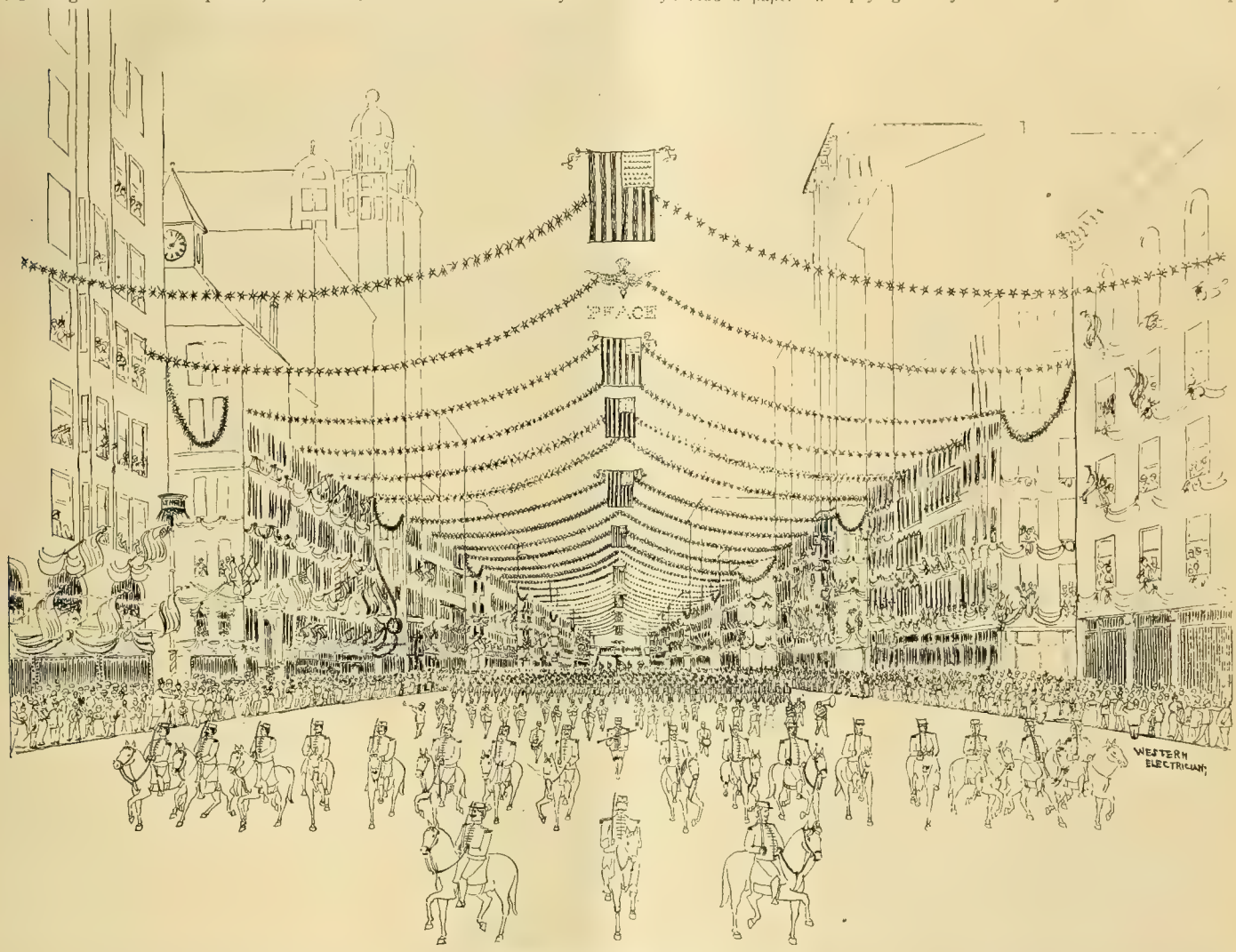
Proposed Jubilee Illumination in Chicago.

On the occasion of the great Peace Jubilee in Chicago next month the electrical decorations and illumination will form one of the greatest attractions of the show. The general plan of display is in charge of the committee on decorations, of which Louis M. Stumer, a State street merchant, is chairman. Mr. Stumer says that one of the leading features will be arches, studded with incandescent lamps, at the street intersections. It is also expected that there will be other arches, of various designs, erected by private enterprise, along the line of march. There will be undoubtedly a distinctively electrical arch and probably emblematic arches by the city of Chicago, Board of Trade and others. The Union Loop structure, too, will doubtless be illuminated.

Still another plan of illumination is that shown very clearly in the illustration. This was suggested by John T. Shayne and developed by J. H. Goehst of the Chicago Edison company. It was originally intended to span all the streets over the line of march in the manner shown, but this plan was afterward thought to be too expensive, as the erection and maintenance of 20,000 lamps of 16 candle power each would be required for the evenings of a week. However, it is promised that the plan shall be carried into execution, but only over a portion of the route originally proposed.

The line of march finally adopted is as follows: Forming in Michigan avenue north and south of Congress street, to march west in Congress to State, north in State to Randolph, west to Dearborn, south to Adams, west to La Salle, north to Washington, west to Franklin, south to Jackson, east to Michigan avenue and disband. In the picture the observer is placed near the corner of Randolph and State streets and is looking south on the latter thoroughfare.

The festoons of lamps are to be supported on galvanized-iron span wires fastened at the fourth-story windows of the adjacent buildings. They are to be 80 feet apart, and each festoon will have about 100 lamps at 12-inch intervals. In the original plan the large dove and the word Peace, shown in the illustration, were to be outlined in colored lamps at some prominent corner.



PROPOSED JUBILEE ILLUMINATION IN CHICAGO.

An ordinance has been passed by the City Council of Sumpter, Ore., granting to Frank Geiser and others an electric-light franchise for a period of 25 years with the right to maintain, construct and erect an electric-light plant in the town of Sumpter.

New York Street Railway Association.

On September 13th and 14th the sixteenth annual meeting of the Street Railway Association of the State of New York was held in the Manhattan Beach Hotel. President G. Tracy Rogers of Binghamton presided, and the roll-call showed an excellent attendance. Letters of regret from Governor Black and others were read.

In his annual address President Rogers reviewed the street-railway history of the year, dwelling particularly on the great advancement in New York and Brooklyn. "The interest in the cable system is now purely historical," he said. "It has served its purpose, and served it well, but its day is done." Mr. Rogers touched on many topics of interest to street-railway men. He remarked that over 170,000 people are employed on the street railways of the United States, which represent an invested capital of $850,000,000 and a trackage of 16,000 miles.

The executive committee reported a larger membership than ever before and a comfortable balance in the treasury. Profound sorrow was expressed for the death of Hon. Edmund O'Connor, the attorney of the association.

H. M. Kennedy of Brooklyn read a paper on "Methods of Developing New Traffic on Street Railways." This paper was discussed at length, and the amusement question was thoroughly canvassed.

"Signal Service on Single-track Roads" was the important subject assigned to H. S. Cooper of Schenectady. Mr. Cooper read a short paper, which brought out a valuable discussion.

The next paper was on "By-products of the Power House," and was written and read by Dr. M. M. Fenner of Fredonia. This paper was discussed at Tuesday afternoon's session by Professor R. C. Carpenter and others.

The report of the committee on "Track Bonding" was made by R. P. Brown and G. E. Chapin of Brooklyn and read by the latter. It was briefly discussed. W. J. Clark read a paper on "Electric Railways as Auxiliary to Coast Defense" and Mr. Moxham one on "Rails: Their Construction from a Scientific Standpoint."

A short paper on "Track Construction" was presented by D. F. Carver of Brooklyn, and considerable discussion ensued. A discussion on storage batteries, given on another page, followed. The last paper was on "The Relation Between the People and the Street Railways," by T. J. Little, Jr., of New York.

On Wednesday morning the following-named officers were elected: President, G. Tracy Rogers of Binghamton; first vice-president, W. Caryl Ely of Niagara Falls; second vice-president, Albert L. Johnson of Brooklyn; secretary and treasurer, Henry A. Robinson of New York city; executive committee, Herbert H. Vreeland of New York, John W. McNamara of Albany, Henry M. Watson of Buffalo and Clinton L. Rossiter of Brooklyn.

Ithaca was chosen as the place of next year's meeting.

After a brief addres by Mr. Sugahara, the Japanese engineer who was at the Boston convention, the meeting was adjourned.

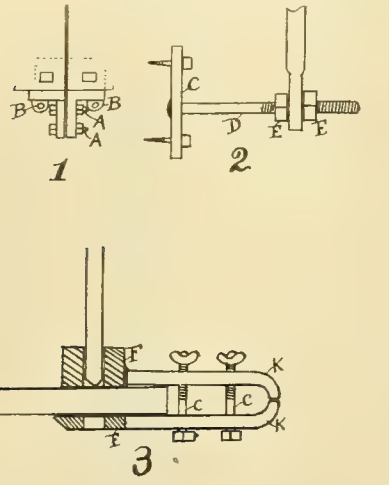
Value of Trolley Franchises in New Jersey.

[From the Elizabeth Daily Journal.]

Papers in other cities are inquiring, "If the trolley franchise between Elizabeth and Plainfield is worth $250,000, what is such a franchise worth in our own cities?" This is a question to be answered according to conditions. In some places it is worth very little; in other places it is worth a great deal. A franchise is valuable in proportion to the dividend-paying ability of a trolley road constructed upon the route for which the franchise is given. The road between Elizabeth and Plainfield would have had very little value to a trolley or horse-railroad company 10 or 12 years ago. At that time it could have been had for the asking, probably. But since Union County has paid $100,000 to improve the road, property all along it has been greatly improved; values have appreciated, population has increased, the demands for travel have grown, the electric trolley has come in just the opportune time. Between Elizabeth and Plainfield there are now no less than nine stations on the steam railroad which parallels Westfield avenue, nearly one for every mile, with scores of trains running in each direction every day. Nothing is more conclusive of the fact that a trolley line on this road is a necessity, and where public travel demands so many accommodations there is a paying field for investment in the building of a trolley line. This is what has made the Westfield avenue franchise worth $250,000. It may be said in this same connection that it is useless to mourn over lost opportunities in past years to sell valuable franchises. They were not so valuable then as now, and the people were not so well informed as to their actual value. The thing to be done from this time forth is to get from corporations desiring valuable franchises a fair and reasonable price for them; and for this lesson the public is greatly indebted to Frank Bergen and the Hon. John Kean.

Construction of Switchboards.

An engineer of experience justly remarks that the construction of switchboards in such a manner as to comply with the requirements of the insurance men and conform to the needs of modern designs of connection is an important subject. Usually switchboards are constructed of prepared wood, slate or marble. The first kind requires that the wood be hard, close-grained, well-seasoned and filled. Several forms of fillers are available, and, of course, the kind that best prevents absorption of moisture is



CONSTRUCTION OF SWITCHBOARDS.

preferable. Slate boards are very effective when they are prepared with a smooth surface and finished with a dark-colored enamel. The slate slabs can be purchased ready sized and uniformly smooth, but the enamel has to be flowed on by the constructor. Bicycle enamels are bought in cans. One coat is flowed on the slab and this is baked in an oven. Another coating follows, which is also baked, and about one more surfacing will complete the operation and give the slabs the appearance of hard rubber polish. The marble board is usually finished in its natural state and looks well if kept in good condition.

Setting Up.

The process of setting and supporting the slabs of either marble or slate calls for notice. The slabs are required to be true, in an upright alignment, with edges flush and the adjustment perfectly solid. Angle pieces may be wrought from strip-iron, and these, when bolted flush to the edges of the slabs, can in turn be clamped with bolts and connected with the wall rods. Fig. 1 shows the plan of using forged seats at the juncture of the slabs of slate. The wrought pieces are drawn with flanges and these flanges are clamped together by means of the

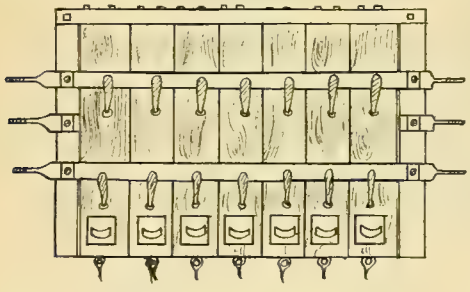


FIG. 6. CONSTRUCTION OF SWITCHBOARDS.

bolts A A. The back parts of the pieces are bolted to the slabs, as shown, and, as extensions B B are provided, the iron rods or wall braces can be easily connected. Fig. 2 illustrates the detail of one of the wall rods. The wall piece is marked C. The rod D is cut with a thread for some distance so as to permit the use of two nuts E E, one on either side of the lip of the extension. This allows a range of adjustment by simply altering the nuts.

Boring Holes in Marble and Slate.

Many of the troubles experienced in drilling one-fourth to three-fourths-inch holes in marble and slate slabs are overcome by the use of the little home-made device presented in Fig. 3. The object of the instrument is to maintain the boring tool in a correct position during the cutting. First shape two pieces from tool steel about 10 inches long by two inches wide and three-fourths inch thick. Weld or rivet the head pieces F F to the ends of these pieces and drill holes for the five-eighths-inch adjusting bolts C C, as shown. The bolts should be planned to operate with thumb heads or by wrench. Then drill the head pieces with a bore the same size as the drill intended to be used. The device is then clamped in position and serves to guide the boring tool into the slate or marble.

Connecting Bus-bar Stands.

The stands for supporting the bus-bars to the back of the slate must necessarily be firmly secured. As they are about six inches from the back of the switchboard, ordinary means of connecting by screws, as in Fig. 4, does not always answer. A tolerably good thread can be cut in a hole previously bored in the slate or marble, and a screw can be inserted and tightened up on the stand with sufficient firmness to assure security under ordinary conditions. If the stands are secured by means of a bolt with a nut, thus providing pressure from either side, the job will be more effective. The writer has overhauled loose screws very frequently, and finding the thread worn and broken in the slate, has enlarged the hole by boring, put in a shell H, as in Fig. 5, and utilized a bolt the same size as the old screw, as shown.

General Plan.

The modern patterns of switchboards, as a rule, require that the switches, voltmeters, wattmeters, amperemeters, circuit breakers, etc., be placed on the front of the board, while the connections are confined to the back of the board. This is quite different from some of the older designs, but it has its advantages. In designing the knife switches, be sure and adjust them so that the gravity will have a tendency to open them. If the reverse order is followed, complications are likely to arise. Also take care that the cut-outs and connections be set so that when the cut-out is opened, positive disconnection of all the wires will occur.

Location.

Moisture, steam, etc., must be kept away from electrical apparatus, if possible. Consequently do not set a switchboard in the vicinity of steam or water pipes. As all switchboards require more or less attention, arrangements should be planned at the start to have all parts accessible from either side. Keep all parts clean and free from dust, waste and general foreign matter.

Hastily Made Switchboard.

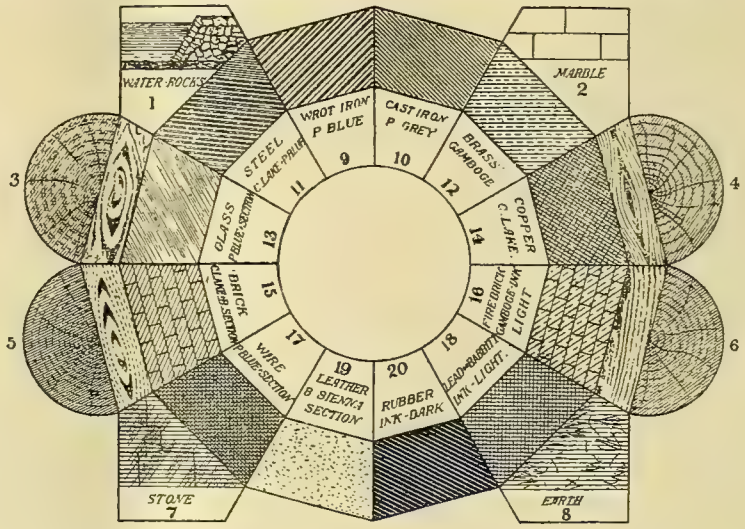
Circumstances may require that a switchboard be erected in a few hours to meet an emergency. Fig. 6 is a sketch of one made by the writer in three hours. The frame is all wood, made from pieces collected about the shop. The bus-bars were hastily attached by means of wooden stands. The drawing shows the position of the positive, negative and neutral bars.

A Russian Magnetic Ore Separator.

The Dellvik-Grondal magnetic separator for enriching fine iron-ore slime has been employed for some years at Pitkaranta, in Finland. According to the Wermlandska Annaler, the raw ore is ground in water by means of a ball mill, which is capable of converting daily, with a force of 15 horse power, from 30 to 60 tons of moderately hard iron ore of about two-inch lumps into fine powder. The material is enriched from an iron content of about 25 per cent. to one of 66 to 68 per cent., while the waste only contains one per cent. of iron, not including iron silicate. The separator has the appearance of two rather high drums, or barrels, which in one place are cut off by vertical planes and brought together. In one barrel revolves the separator, consisting of a vertical shaft fitted with cast-iron sheaves placed two inches apart, which derive their magnetism—strongest at the upper sheave—from electric winding; and in the second barrel, corresponding with the cast-iron sheaves, small iron plates revolve at the distance of from 1½ to two millimeters from the sheaves. The ore, formed into slime by water, runs directly from the ball mill, and trickles off from the upper conical portion of the separator on to its periphery. Particles not containing iron are washed away directly by a further quantity of water, allowed to flow into the separator, while the ore is attracted by the periphery of the sheaves, to which it adheres. The sheaves set up magnetism of the opposite name in the small iron plates of the barrel, owing to which the grains of iron ore leap over and immediately afterward fall to the bottom, because the magnetism decreases with the distance from the separator sheaves. The iron ore thus obtained in the form of powder is made, without any addition, into briquettes, which are burnt at a temperature of 800° Centigrade, and melted in the blast furnace.—Engineering and Mining Journal.

Conventional Sections for Mechanical Drawings.

An English technical contemporary gives the accompanying chart of conventional sections for mechanical drawings; the work of preparing it is credited to Mr. John Reid of Sibley College, Cornell University. The section marked 1 represents a section of rock, wall and water. When used without color, as in tracings for blue printing, the rocks are simply shaded with india ink. For color drawing the groundwork is made of gamboge or burnt umber, and the water is shown by a blended wash of prussian-blue. The convention for marble is



CONVENTIONAL SECTIONS FOR MECHANICAL DRAWINGS.

shown in 2. To color this the whole section is made thoroughly wet, and each stone streaked with Payne's gray. Building stone in general may be shown as in 7, or colored with a light wash of Payne's gray, the shading lines being added with ruling and writing pens. For earth, india-ink and neutral tint, with india-ink irregular penned lines are used.

Chestnut is represented as in 3, to color which a ground wash of gamboge with a little crimson lake and burnt umber is used. The colors for graining should be mixed in a separate dish, and are burnt umber, Payne's gray and crimson lake in equal but sufficient quantity to make a contrast with the ground color. The No. 5 represents black walnut. The coloring, when desired, consists of a ground of Payne's gray, burnt umber and crimson lake in equal quantities, using the same mixture, with the addition of more burnt umber, for graining. Hard pine, drawn as in 6, is colored with a light wash of crimson lake, burnt umber and gamboge in equal parts, with a graining mixture of crimson lake and burnt umber.

Woods in general are shown in 4, which should be colored with a light wash of burnt sienna and grained with a writing pen, and a dark mixture of burnt sienna and india-ink.

The other sections are solid wash colors and need no explanation beyond that given in the cut.

It is not intended that these sections, and more particularly the coloring, should be used for rough or hurried drawings. In preliminary work for estimates, and in many other cases, well-finished and artistic drawings are necessary, and in such instances the conventions given will be useful.

The South Side Elevated Railroad company of Chicago continues to maintain its percentage of increase in traffic, as compared with last year. The total number of passengers carried last month was 1,293,870, or an average of 41,770 a day. This represents a decrease of 2,378 as compared with July, but it is 14,696, or 54 per cent., ahead of August, 1897.

Three-phase Work in the Merrimac Valley.

For two years past the Merrimac River valley in New Hampshire has experienced unusually high water, seriously interrupting the service of the Concord Land and Water Power company, operating the big three-phase electric plant at Sewall's Falls, supplying the city of Concord. Recently an auxilliary steam plant has been installed, thus guaranteeing reliable and uninterrupted service. This steam plant (Fig. 1) is located near the city and consists of a cross-compound Buckeye engine of 500 horse power direct-connected to a General Electric three-phase 375-kilowatt generator, which runs at 215 revolutions. A 600 horse power Babcock and Wilcox boiler furnishes steam at 150 pounds through a Stratton separator.

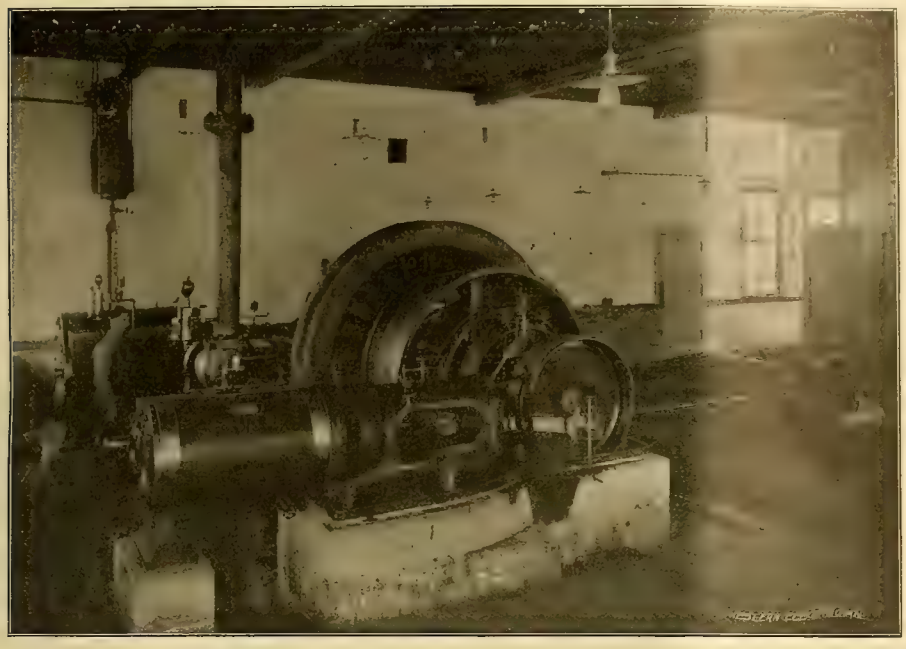


FIG. 1. THREE-PHASE WORK IN THE MERRIMAC VALLEY.—AUXILIARY STEAM PLANT.

The convenience and adaptability of the three-phase electric power distribution is illustrated in the recent installation for the New England Granite company at Concord of a 20 horse power induction motor for operating a four-drum derrick hoist. The motor is designed for variable speed, taking current at 110 volts and 50 cycles. This installation was made by Superintendent George Lauder of the Concord Land and Water company, and is the largest in the city, though not the first. The motor-hoist combination is shown in Fig. 2.

Use of Storage Batteries in Railway Plants.

At the request of President Rogers two prominent members of the Street Railway Association of the State of New York gave their experience with storage batteries at the meeting last week. Mr. Littell of Buffalo said that his company's battery had been in use about nine months. "It is an auxiliary of our power house," he went on. "As many of you are aware, we get a certain amount of our power from Niagara Falls—2,000 horse power—and we have nominally 7,000 mechanical horse power in the plant in steam power. The storage battery was put in partly as an experiment. I had great difficulty in convincing my directors that it was a good thing. When we put it in we made a contract for 1,200 horse power hours. But in making my contract I provided that the cells should be large enough so that I could increase the battery 66 2-3 per cent. I think we will soon increase it; we are very much pleased with it. I cannot tell you very much about it, but it has the same effect upon our plant as a safety valve would have upon a steam engine or as a standpipe would have upon a waterworks; it takes all those sudden calls upon us for energy. There have been times when we had but one engine in use, a 1,200 horse power engine, with the 2,000 horse power from the Falls, and the Falls power for some reason stopped on us; but the cars went on. The people didn't know it. The battery held us for 15 or 20 minutes until we could get in more engines. We had cases at night where we shut down the power from the Falls and ran three or four hours with the battery. We have tested it in every possible way, and I am a firm believer in it. I think it is a good thing for a steam plant as well as for a plant like ours. I am not interested in a storage battery or any accumulator. I am simply a believer in it."

Mr. Vreeland of New York said: "As a result of considerable experience with storage accumulators as an auxiliary to power plants in Philadelphia and in Pittsburg, we have just contracted for one of the largest storage-battery plants that has ever been erected for a street-railway company, as an auxiliary in our work the coming winter. Our situation is a little peculiar. We are building a very large power station of 70,000 horse power, and it will not be ready until next spring. We have not sufficient power to carry us over the winter by direct current from the generators. We had determined upon a storage auxiliary to this large plant when completed, but we have concluded that by using a portion of the plant at the present time we can get sufficient storage capacity to take the peak of our load during the winter months up to the time when we get our large house completed, when we will probably put in batteries of three or four times the capacity of that now being located.

"The experience of our plants throughout the country, where the batteries have been used, and all of the experience of the engineers in charge with whom I have communicated, both in electric lighting and electric street railroading, is that it is an economical auxiliary to any plant which has reached the limit of the power capacity in very heavy hours. The plant in Philadelphia was placed where there were some extensions made at a point where the station that fed that section of the city had reached the limit of its capacity, and it was either necessary to build another plant or add some storage capacity in that section of the city, which was the original cause for the installation there.

"The storage-battery question, as an auxiliary to that extent, is very satisfactorily determined by the tests in electric-lighting stations and for some time lately with the street railroads.

"One of the most eminent electrical engineers in this country, who has large experience with the storage battery and spent some years in a company that was attempting to perfect and operate a storage battery, whom I sent for a year or two ago to talk over the question in conjunction with the Chicago system, which was to use an accumulator car, said that after years of experimental work in conjunction with storage batteries, he had come to the conclusion that as storage batteries got their power from destruction—the eating up of the plates—and as that could be accelerated by motion, the economical place for a storage battery was in a large safe. Loose the combination, he said, with the wires carried out, and then you would get a commercial storage battery."

President Rogers asked if the storage batteries were economical for smaller roads in provincial cities, say of 25 or 30 cars or 50 cars, where the plant has reached its maximum. "Is it economical to put in a battery plant or are the accumulators too expensive for us to put them in?"

Mr. Littell thought any road running 30 to 50 cars could afford a storage battery and would be justified in putting one in.

Mr. Rogers: Is the expense of the storage battery being reduced?

Mr. Littell: The original cost is quite expensive. I think we will get our cost back the first year.

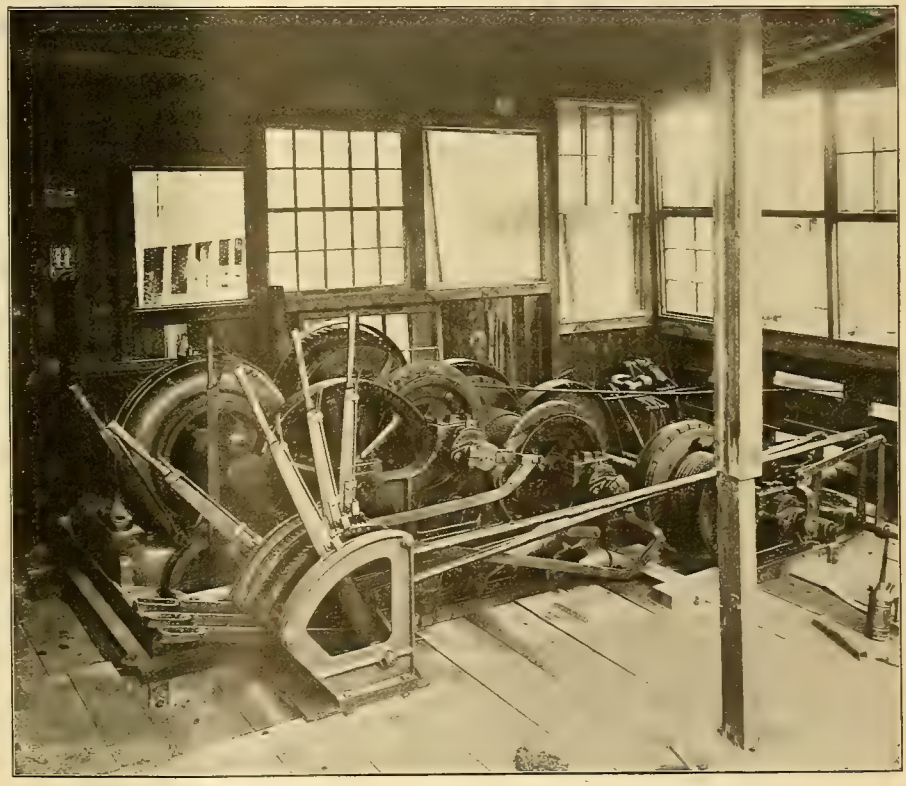


FIG. 2. THREE-PHASE WORK IN THE MERRIMAC VALLEY.—ELECTRIC HOIST.

COMMUNICATION.

About an Institute Badge.

To the Editor of the Western Electrician:

In the New York Journal (evening edition of September 15th and morning edition of September 16th) is given what purports to be a list of members of the American Institute of Electrical Engineers to whom were furnished the society pin of the so-called "kite design," which was abandoned in 1897.

One of these pins was found on the clothing of a woman killed on Staten Island. As I refused to supply any reporter with a list of members owning these pins, I deem it proper to inform you that out of the 20 names printed in the Journal, only seven were owners of the style of pins referred to. The names were simply taken promiscuously from our catalogue of 1,100 members.

As only 264 of the members originally possessed the pins, and 32 have since been returned, the impossibility of any person compiling a correct list without access to the books of this office is apparent.

RALPH W. POPE,
Secretary, American Institute of Electrical Engineers.

New York, September 16, 1898.

The electric-light company at Grundy Center, Ia., will put in street steam-heating mains at once. The company has contracts for heating the court-house and several other buildings.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK

CIRCULATION, 20,000.

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Unless all signs fail, the electrical display at the Chicago Peace Jubilee in the latter part of October will be brilliant and spectacular and form one of the chief attractions to visitors. As there will be similar celebrations at about the same time in other large cities, the sellers of electrical current will be very sensibly benefited.

The consolidation of the Westinghouse and Walker companies is an event of much interest to all electrical men. In so far as it indicates a tendency to fasten a patent monopoly on the electrical business of the United States it is to be regretted. If it shall make for improvement in apparatus, reduction in factory and selling expense, the abolition of cut-throat competition and extension of the export trade, the alliance of the three great companies will be commended. Of course it is impossible to secure an actual monopoly of the manufacture of the older types of dynamos and motors in this country, and if the allied companies will deal fairly with the consumers in respect to such apparatus as they do control, all may be well. But the electrical industries of the United States are too powerful and widely extended to be successfully laid under tribute for any length of time.

The discussions attending the introduction of the electric railway in Great Britain show all the familiar features of a few years back in the United States, with added troubles "made in England." Just now the English friends of the electric lines are dwelling on the advantages of cheap and rapid transportation to suburban districts, where every workingman can have his own house and little plot of ground. It is urged, too, that electric-railway communication will greatly relieve the monotony of village life, and this is equally true. But here arises a serious question to be considered by the British advocate of electric traction—the municipal-ownership complication. In England, as a recent writer in the London Times has pointed out, the present tendency to municipalize everything threatens to deprive the villages and small towns, which are not populous enough to support their own railway systems, of the advantages of the improved means of transit which light electric railways afford, because if the tramways and light railways within the large towns are owned by the municipalities, it will not pay private capitalists to provide light railways in the adjacent and sparsely populated districts. Municipalities cannot very well, for various legal and practical reasons, go beyond their boundaries, whereas if the development of electric railways is left to private enterprise, there would be no such obstacles to urban tramways being extended as light railways from one town to another, and in their course passing through intervening villages, and bringing them into easy and direct communication with the towns, and thus very greatly diminish the dullness of village life. "The tendency to municipalize industries is carried too far," it is mildly asserted, "when municipalities enter upon undertakings which, for their proper development, require to be carried beyond the municipal boundaries." It is a pity that the industrial activities of the English people should be hampered by such a stubborn, non-elastic conservatism.

Whatever Sir William Crookes has to say to the scientific world is sure of an attentive and deferential audience, and there will be no exception, certainly, in the case of his recent presidential address before the British Association at Bristol. But we shall be surprised if his suggestion to produce "electric nitrate" on a tremendous scale to fertilize the wheat-lands of the world, to avert the future "deadly peril of not having enough to eat," is not regarded as fantastic rather than convincing or practicable.

All of Sir William's preliminary calculations seem to us labored and unduly pessimistic. He says that "As mouths multiply food resources dwindle. Land is a limited quantity, and the land that will grow wheat is absolutely dependent on difficult and capricious natural phenomena. I am constrained to show that our wheat-producing soil is totally unequal to the strain put upon it." With this situation staring us in the face, starvation may, however, be averted, as we are told, by the electro-chemical laboratory.

We cannot think that even so eminent a scientist as the distinguished essayist can be regarded as accurate in a statement such as that to the purport that there is no virgin land left for wheat cultivation in the United States. The possibilities of irrigation, the great tracts of uncultivated land in Canada and South America, possibly in Central Asia and Africa, the thoughtful consideration of rice and other foods —these and like factors that might well be pondered in studying the world's food supply seem to have been passed over by the president of the British Association. His reasoning is far from conclusive, although apparently advanced in all seriousness.

But the conclusion of the speculation is interesting, at all events. Sir William shows that, to be highly productive, the wheat-lands demand nitrogen fixed in the form of ammonia or nitric acid. The only practicable nitrogenous manure for use on a wide scale is nitrate of soda, but the supply of it will be exhausted in 50 years at farthest. What then? The store of nitrogen in the atmosphere is practically unlimited; but how shall we fix it for use as a plant food? The speaker went so far as to say that the fixation of nitrogen is vital to the progress of civilized humanity. Unless the problem is successfuly solved, he declared, "the great Caucasian race will cease to be foremost in the world and will be squeezed out of existence by races to whom wheaten bread is not the staff of life."

As far back as 1892 Sir William Crookes showed that nitrogen is a combustible gas, and the reason why when once ignited the flame does not spread through the atmosphere and deluge the world in a sea of nitric acid is that its igniting point is higher than the temperature of its flame—not, therefore, hot enought to set fire to the adjacent mixture. But by passing a strong induction current between terminals, the air takes fire and continues to burn with a powerful flame, producing nitrous and nitric acids. "This inconsiderable experiment," said the lecturer, whose language, in abstract, we now quote, "may not unlikely lead to the development of a mighty industry destined to solve the great food problem. With the object of burning out nitrogen from air, so as to leave argon behind, Lord Rayleigh fitted up apparatus for performing the operation on a larger scale, and succeeded in effecting the union of 29.4 grammes of mixed nitrogen and oxygen at an expenditure of one horse power. Following these figures, it would require one Board-of-Trade unit to form 74 grammes of nitrate of soda, and, therefore, 14,000 units to form one ton. To generate electricity in the ordinary way, with steam engines and dynamos, it is now possible, with a steady load night and day and engines working at maximum efficiency, to produce current at a cost of one-third of a penny per Board-of-Trade unit. At this rate one ton of nitrate of soda would cost £26. But electricity from coal and steam engines is too costly for large industrial purposes; at Niagara, where water power is used, electricity can be sold at a profit for one-seventeenth of a penny per Board-of-Trade unit. At this rate nitrate of soda would cost not more than £5 per ton. But the limit of cost is not yet reached, and it must be remembered that the initial data are derived from small-scale experiments, in which the object was not economy, but rather to demonstrate the practicability of the combustion method, and to utilize it for isolating argon. Even now electric nitrate at £5 a ton compares favorably with Chili nitrate at £7 10s. a ton; and all experience shows that when the road has been pointed out by a small laboratory experiment, the industrial operations that may follow are always conducted at a cost considerably lower than could be anticipated from the laboratory figures. But how about electricity? Can we generate enough energy to produce 12,000,000 tons of nitrate of soda annually? A preliminary calculation shows that there need be no fear on that score; Niagara alone is capable of supplying the required electric energy without much lessening its mighty flow. The future can take care of itself. The artificial production of nitrate is clearly within view, and by its aid the land devoted to wheat can be brought up to the 30-bushels-per-acre standard. In days to come, when the demand may again overtake supply, we may safely leave our successors to grapple with the stupendous food problem."

Thus does Sir William Crookes deal with the problem he has created. It is interesting; but it will be very surprising indeed if the two laboratory experiments which he cites prove the forerunners of the vast electro-chemical fertilizer production which his imagination has conceived. The two extremes are too distant.

We must very briefly refer to three of the remaining topics touched upon in the presidential address. Sir William Crookes says that "wireless telegraphy" is already developing into a successful practical system in Marconi's hands, and that it will be used largely in lighthouse and marine work. He points out that it presents more analogy to optical signals by flashlight than to what is usually understood as electric telegraphy. Some advances in the mechanical construction of Röntgen-ray tubes are noted, and the nature of the radiation is considered at some length. No other source for Röntgen rays but the Crookes tube has yet been discovered, but rays of kindred sorts are recognized. Finally, Sir William Crookes announces the discovery of a new element, which he has named monium.

Westinghouse Company Absorbs the Walker Company.

The consolidation of the Westinghouse Electric and Manufacturing company and the Walker company, or, as it is termed in Pittsburg, the purchase of the Walker company by the Westinghouse company, was effected last week. The details of this important deal are not, naturally, made public, but the following Associated Press dispatch from New York, dated September 17th, is probably about correct:

"The official announcement was made to-day that the Westinghouse Electric and Manufacturing company of Pittsburg had secured a working consolidation with the Walker company of Cleveland. This leaves the field of electrical manufacture to the Westinghouse and General Electric companies, which have had a working agreement for some time. It will also put an end, it is said, to the long series of litigations which have resulted over patents. The capital stock of the Westinghouse company is $15,000,000, and that of the Walker company is $2,500,000, with $2,500,000 bonds. The Walker company numbers among its incorporators and directors ex-Governor Flower, Major Hinkley, former chairman of the New York Democratic state committee, and Perry Belmont. The report is current that the New York Air Brake company may be let in. That concern has its works at Watertown, this state, the home of ex-Governor Flower, who is much interested in its affairs. Messrs. Flower and Hinkley and Anthony N. Brady will enter the board of directors of the Westinghouse company. The Westinghouse company has $4,000,000 of preferred stock and $8,000,000 assenting or common stock."

It is claimed that Perry Belmont and his brother August, who is a large stockholder and one of the directors of the Westinghouse company, conceived and consummated the deal. August Belmont has been a director in the Pittsburg company since 1890. The consolidation will have no immediate effect on the operation of the respective plants of both companies. Both factories are busy as it is. It is probable that the Chicago agency of the Walker company will be continued for the present at least. J. Holt Gates is the Walker company's representative in Chicago and Maurice Coster is in charge of the Chicago office of the Westinghouse company.

Professor S. H. Short, the vice-president and chief electrical engineer of the Walker company, talked freely of the situation in an interesting interview in a Cleveland paper. The interview seems to have been carefully prepared, although Professor Short may have been incorrectly reported in the statement that the Walker company won all its patent suits. Professor Short is quoted as follows:

The history of the Walker company is very interesting. It was started by Jacob Perkins, who was induced by John Walker to invest some money in a little machine shop on the West Side. The business increased, and when the cable car was shown to be not only practicable but successful, by the original road in San Francisco, the Walker company went right into that line of work. The big shops on Waverly avenue were built and for a time things went swimmingly. The Walker company furnished fully 90 per cent. of all the cable-road machinery in use. It built the Yerkes system in Chicago, the Broadway road in New York and many other roads in other big cities. About 1892 the electric railway began to take such a strong hold on investors that it sounded the death knell of the cable road. No one wished to build a cable-road, and the business of the Walker company dwindled down to practically nothing. In 1893, the year before we took hold, the Walker company did a business of only $100 000. Last year it amounted to over $2,000,000. In the five years after it was changed into a factory for the production of machinery for electric roads it has worked up to these large figures.

But they only measure its growth; they do not limit it. We have orders that run up to millions now on our books, and if we did not get another order we would be hard at work for over a year. But we are constantly increasing our business, especially in Europe. Last year we did a business of fully $1,000,000 with the people across the water. We were out after everything and we generally got it.

Naturally this made the other companies, the Westinghouse and the General Electric company, a great deal of trouble, and so we were not unprepared for the offer of consolidation that came to us from the Westinghouse company about two months ago. Hints to that effect had been given us for some time.

Then, there was the question of patents. That was an important figure in bringing about this offer. The Westinghouse people and those of the General Electric company were always at loggerheads over patents, and we were constantly being brought into the fights. But we always won, for we never used a patent of the other companies, or rather one which they claimed, that we could not and did not show was either invalid, or that our use of it was not an infringement.

Take the case of the overhead trolley; the kind you see used here on all the roads. The General Electric company claimed its exclusive ownership, and when the Westinghouse people proceeded to use it, the General Electric company brought immediate suit against them and won their suit in a lower court. Then the Westinghouse company gave up manufacturing that sort of a trolley. We were making this trolley and the General company sued us also. When their case was won in the lower court we did not lie down like the Westinghouse people, but appealed it to the highest court in the land and were victorious. This same course was taken in a dozen cases, and in all of them we were successful. So, taking into consideration our phenomenal growth, which threatened the supremacy of the Westinghouse company, and our success in fighting the patent cases that were brought against us, it was thought that it would be better to take us into the fold than continue this unequal warfare. The fact that we got the contract for the largest electric generator in the world, that at Boston, and that we were also awarded the contract for equipping the Brooklyn elevated road, made the Westinghouse people all the more anxious for a speedy arrangement with us.

As I said, the deal has been considered about two months, and it was consummated late on last Friday night. No; it is not an unlucky day. Friday has always brought me my best fortunes all through life.

The Westinghouse company and the Walker company are consolidated, but in certain ways we shall retain our identity. The finances of the company will be managed from the Pittsburg end, but all the present officers of the Walker company will be retained with all their old executive powers and the works here will be run with even greater energy than before. Three of the Walker people will be on the Westinghouse directorate: President J. W. Hinkley, ex-Gov. Roswell P. Flower and Anthony N. Brady, who is generally called the "trolley king," from the fact that he has a big interest in all the big trolley lines of the East.

We now employ about 1,000 men and our shops cover about 10 acres. I expect that we shall have to add to both within the near future. I shall go back to New York either Monday night or Tuesday (September 19th or 20th). We have a meeting there on Wednesday. On Thursday I shall return and Mr. George Westinghouse will come with me. Then we shall canvass the purchase of more land for extra buildings. Mr. Perkins has promised to sell us all we wish. Personally, I favor adding to our property at the west, along the Lake Shore track, but it may be decided to build in the direction of Detroit street.

The New York dispatches state that there is supposed to be an "understanding" between the Westinghouse company and the General Electric company. That is true. It has been in force about eight months, I believe, and by its provisions there is an interchange of patents. The Westinghouse company has the right to use those of the General company, and it shows a reciprocal kindness. Then, there is an understanding between them as to prices. The two companies maintain their identities, but they work together along these lines. I presume that the outcome will be a consolidation between them at some time, but when that will occur or upon what terms, of course, I cannot say.

Another thing that this consolidation will bring about is the apportionment of work to the company that is best fitted to do it. The Walker company has the best facilities in the world for the manufacture of big electrical generators and heavy electric engines. That sort of contracts will be given to us, no matter who gets them. The Westinghouse company put in the machinery at Niagara for the transmission of electricity many miles, and it is unequaled in such work. Naturally it will do it when any of the three companies gets a contract along those lines, and the General Electric company has its specialties, also, and will look after them.

So far as increase of rates go, there will be no decided raise at present. Things will be shaded a little better for the companies from time to time until there will be the right profit. This question of rate cutting was a serious one and now it will be done away with.

Our consolidation has a laughable side to New Yorkers, and for this reason: Not long ago Russell Sage and George Gould, who own the Manhattan elevated system, desired some further concessions from the state and city, and in order to get them promised to put in electricity instead of steam. All the three companies began to figure on bids, and I was there for over three months making plans and estimates. The concessions were granted Sage and Gould, and then they decided that they would postpone putting in electricity; it was too expensive. That is where they made their mistake, and that is why all financial New York is now laughing at them. At that time the competition between the Westinghouse, the General and the Walker was so great that any one of them would gladly have taken the contract at cost. Now that they have united the price will go up, and Sage and Gould will lose a pretty penny by their trifling.

Association of Edison Illuminating Companies.

The nineteenth convention of the Association of Edison Illuminating Companies was begun at the Hotel Iroquois, Sault Ste. Marie, Mich., September 12th. There was a large attendance, and the convention was a success both in respect of work done and in its social features.

The greater part of the attendants arrived at Sault Ste. Marie by the steamer Northwest from Buffalo and Detroit Sunday evening, September 11th, and returned by the same steamer, leaving Wednesday afternoon. The lake trip was highly enjoyed and was one of the most pleasant features of the convention of 1898, especially as it afforded opportunity for an interchange of opinions and experiences. At Mackinaw Island, on the upward trip, the delegates and the ladies of the party were entertained by a carriage ride to points of interest, the invitation being tendered by the General Electric company. At the "Soo" the Edison Sault Electric company arranged carriage and steamboat excursions and also provided canoes and Indian guides to carry the more venturesome members of the party through the rapids of the St. Mary's River. The thanks of the ladies and of the association were tendered to the Sault company and to the General Electric company for these courtesies.

The first meeting was opened promptly at 9 a. m. Monday, September 12th, by President Insull. There was no formal presidential address. After roll-call the Edison companies of Detroit, Chicago, Brooklyn, New York and Boston stated by their representatives their experience during the past year and their present practice in making rates for supply, especially low rates for long-hour use, and with particular reference to the Wright and the two-rate methods of charging. The statements showed great diversions in methods, but invariable good results following readjustment in favor of long-hour consumers. The discussion was general, and was, by consent, reopened the next day.

On Monday evening Mr. W. S. Barstow described the Brooklyn transmission system in detail. He was followed by Mr. J. W. Lieb, Jr., who reported what the engineering commission recently sent to Europe by the Edison Electric Illuminating company of New York, consisting of Mr. Lieb, Mr. John Van Vleck, its constructing engineer, and Mr. Arthur Williams, saw there of electrical and mechanical interest. The following discussion was opened by Mr. Herbert A. Wagner of St. Louis and had reference largely to alternating-current practice.

On Tuesday morning Mr. Arthur Williams spoke of European practice in meters and charging systems, lamps, fixtures and details, as observed by the New York company's commission. His talk was followed by three papers on meters and metering, by Mr. E. A. Leslie and Mr. Charles S. Sheppard of New York and Mr. Oliver J. Bushnell of Chicago. These were answered by Mr. Carvl D. Haskins of the General Electric company, and discussed very fully by Messrs. Scovil (Cleveland), Huntington (Spokane), Chandler (Sault Ste. Marie), Barstow (Brooklyn) and Ferguson (Chicago).

A special afternoon session was found necessary, at which the discussion of meters and metering was continued. Two papers were read, by Mr. C. C. Perry of Indianapolis and Mr. F. W. Kingan of Sault Ste. Marie, on the problems of smaller stations, and a very full report presented by Mr. Chandler from the association's committee on Welsbach burners and acetylene gas (Messrs Stetson, Chandler and Leslie).

The last session, held Tuesday evening, received and considered the reports of the executive committee, the committee on incandescent lamps and the lamp-testing bureau. The last-named report was very full and elaborate. The final business was the election of officers for the ensuing year, as follows:

President—R. R. Bowker, New York.

Vice-president—G. R. Stetson, New Bedford, Mass.

Treasurer—W. S. Barstow, Brooklyn.

Secretary—Wilson S. Howell, Newark, N. J.

Executive committee—Samuel Insull, Chicago; Charles L. Edgar, Boston, Mass.; J. W. Lieb, Jr., New York.; Alex Dow, Detroit; J. H. Vail, Philadelphia.

A Combination Absorption and Transmission Dynamometer for Laboratory Purposes.[1]

By J. J. Flather.

In this paper Profesor Flather described some recent improvements in his hydraulic transmission dynamometer, the most notable feature being the employment of a water-cooled pulley and a perforated rim which permits the use of a brake band that can be used for absorbing the power furnished to the machine. The fixed pulley which is ordinarily used to connect the dynamometer to the machine to be driven has internal flanges for carrying the cooling water, and the rim is furnished with a number of brass bushings drilled through endwise and provided with a regulating screw by which the amount of water admitted to the brake is readily controlled. The brake band is a three-ply cotton belt, seven inches wide, connected through two sets of tension springs to the brake-regulating screw.

It will be readily understood that the brake band may be quickly removed, thus converting the machine into a regular transmission dynamometer. In either case an automatic record is obtained on a roll of paper which is caused to pass with uniform motion under an indicator pencil that records variations of pressure.

In addition to the force curve traced by the indicator pencil the zero or datum line is traced by another pencil which is adjustable in position and may be located at pleasure on a line parallel with the axis of the shaft. Thus one is enabled to measure the total power required to run a given machine or any subdivided part of it. The two cylinders through which the driving power is transmitted are each 10 square inches in area and are provided with bronze pistons actuated by plunger pins, which may be located in either of two positions—the inner for ordinary work and the outer for extra heavy work, say, when it is required to measure 20 horse power, or when the speed of rotation is very slow.

It will be understood that springs of varying degrees of intensity may be used to transmit the pressure from shaft to indicator pencil. These springs are changed as in any ordinary indicator.

The work of friction of the plunger in the cylinder is practically eliminated, since the combined area of the plungers is so much greater than in the indicator piston, and, since the indicator motion multiplies the distance moved by the indicator piston five times, it will be seen that the motion of the plungers is exceedingly small. The more recent machines are provided with adjustable casters which permit the weight of the dynamometer to be carried by wheels or to rest firmly on the floor, as desired.

Municipal Ownership Puts a Premium on Whisky Drinking.

It remained for a Scotch town to "municipalize" the saloon business and link it with the electric-lighting industry. The situation is described in the London Electrical Engineer: "The power of whisky to increase the apparent candle power of a lamp is a matter of history, but we gather from the Sheffield Daily Telegraph that in a village in Scotland even better results have been obtained. It seems that a little village near Dunfermline, named Hill of Beath, has municipalized its public house, and installed the electric light out of the profits. This success has raised envy in the soul of another village close by, called Kelty. Kelty does not see why it should not municipalize its whisky drinking, so a public meeting has been held, with a real live county councillor in the chair to propound a scheme. This scheme provides that all profits over five per cent. go to the County Council, but it is not proposed to limit the application of this money to electric lighting. Notice may be expected in the bar to the effect that if a certain quantity of whisky is consumed by, say, January 2d of a certain year, the council will proceed to repave the High street, etc."

Mr. Duffie of Ripon, Wis., has sold the electric-light plant at Mitchell, S. D., which he had just completed rebuilding, after a fire, to W. N. Hollands of De Smet, S. D., and Frank Redford of Mitchell.

1. Abstract of paper read before Section D, American Association for the Advancement of Science, at Boston, last month.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Telephone Service in Elkhart, Ind.

With its new exchange in operation the Elkhart Telephone company is prepared to furnish service to 500 subscribers according to the most approved methods of modern practice. It has recently installed a 500-drop metallic switchboard, made by the Stromberg-Carlson Telephone Manufacturing company of Chicago, which is illustrated in Fig. 1. The company took possession of its new building last May and has been operating its new equipment ever since. By comparing this modern exchange with the original facilities of the company it will be appreciated that considerable advancement has been made. The independent company started in business on December 1, 1895, and its equipment consisted of a 100-drop board (Fig. 2), being the same capacity as the Bell exchange from 1881 to 1892. Within a year the number of subscribers made it necessary to double the capacity of the independent board, and in June, 1896, better facilities were again required, a 300-drop board being installed at that time. In January, 1897, an additional 50-drop panel was added to the board, and this arrangement was continued until May last, when the new exchange was opened.

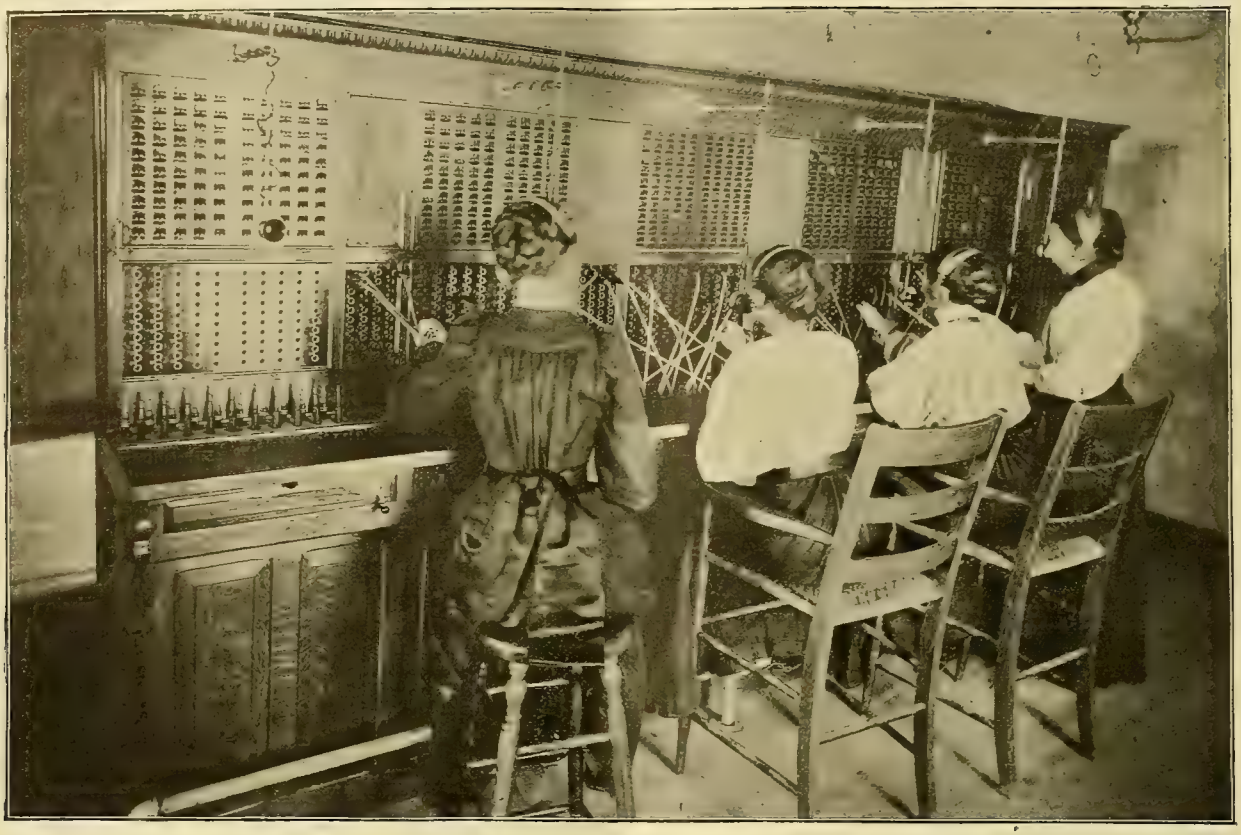


FIG. 1. INDEPENDENT TELEPHONE SERVICE IN ELKHART, IND.—NEW EXCHANGE.

The history of the telephone in Elkhart is essentially the same as that in other Indiana cities, and some of the facts presented in the independent company's pamphlet may be reproduced here to illustrate the conditions that brought about the independent movement in Indiana.

The first telephone exchange in Elkhart was opened for business about 17 years ago. The population was then just about half what it is now. The Bell company made the start and charged $3 and $4 for residences and business places, respectively, per month, until the Legislature fixed a limit of rates at $2 and $3 per month for towns of the size of Elkhart. Rather than obey the law the company removed its telephones and closed its offices not only in Elkhart, but in most of the towns of the state. Finally the inconvenience became so burdensome that a limited number of business men let the Bell company come back at the old rate of $3 and $4, simply because there was no other telephone service to be had at any price. These conditions prevailed till after the expiration of their patents in 1894, when the business men of the city, through one of their organizations, appointed a committee to ascertain if it was not possible to secure a larger, better and cheaper telephone service for Elkhart. It should be borne in mind that while the population and business of Elkhart had increased over 100 per cent., the telephone patrons and accommodations had not grown over 10 per cent. in the same time. The business men's committee had no thought of starting or encouraging an independent telephone movement in 1894, but its overtures were treated in an uncivil manner by the state officers of the Bell company and it retaliated by establishing an independent company. Work on the new plant was begun in April, 1895. On this day the Bell company had about 100 subscribers, after 14 years of operation, at the standard rate of $36 per year for residences and $48 per year for business places, within one mile of the central office. By June 1st most of the poles of the new company had been placed in position and some wire strung. On this date the Bell rates dropped from $36 and $48 to $24 and $36. Repentance came too late, and the work on the home plant progressed.

FIG. 2. INDEPENDENT TELEPHONE SERVICE IN ELKHART, IND.—FIRST BOARD INSTALLED.

Some idea of the trials of the promoters of the new company can be gained from the following statement: "On October 1st we had standing in the streets and alleys of Elkhart probably the best constructed outside telephone plant in the state, but we had neither telephones nor switchboard, nor did we know where or how to get them, owing to the failure of the company we had contracted with. But the Bell company was probably not then aware of our desperation and lack of ammunition, because on that date it cut residence rates to 75 cents and business places to $1 per month. This move proved a great blessing in disguise to our company, because it reassured our people on the question of patent litigation. It was evident that if the Bell company had a sure thing on patents it would not voluntarily throw away its revenue in such reckless fashion. Then, again, this desperate cut convinced everyone that it could not be good-faith competition, and that the people would suffer in the end if such tactics proved successful. All Bell officials now admit that this was bad generalship. To make a long story short, we got started December 1, 1895, with the best apparatus that we could then purchase; but it was in no way comparable with that of our antagonist. The old company was intrenched behind years of experience—as were the Spaniards in Cuba—she had everything desirable, except the goodwill of the people. We opened business with less than 100 subscribers, at the rate of $18 per year for residences and $24 for business telephones. From that day to this we have never had but this one basis of rates."

The present plant is the natural development of the experience of the company. The management claims that its pole lines and general construction compare favorably with the larger plants of the state, and that its exchange equipment is of the very latest design and construction. As already mentioned, the switchboard is of the latest improved metallic circuit, 500-subscriber capacity, manufactured and installed by the Stromberg-Carlson Manufacturing company of Chicago.

The cross-connecting board and cable terminals and protectors are the inventions of Frank B. Cook, who was for 14 years the inventor and chief engineer of the Central Union Telephone company. He is now a member of the Sterling Electric company of Chicago, Ill., through which company this installation was made. The combined cable terminal and strong and sneak-current protector is said to be an absolute protection against lightning and strong and sneak currents of any description. It has the indorsement of the National Board of Fire Underwriters and also the indorsement of the sub-companies of the American Bell by their general adoption of it. The cable capacity is now 550 full metallic circuits—twisted pairs—or 1,100 wires. The outside cable was supplied by the Standard Underground Cable company of Pittsburg, Pa. The inside office cables are all rubber in

twisted pairs and were furnished by the Indiana Rubber and Insulated Wire company of Jonesboro, Ind.

The management of the concern is vested in a board of directors composed of the following-named officers and stockholders:

A. R. Beardsley, president; W. B. Pratt, vice-president; E. C. Bickel, secretary and general manager; S. M. Cummins, treasurer; H. B. Sykes, James Kavanagh, M. U. Demarest. J. M. Van Fleet is general counsel for the company.

The personal supervision of the business is in the hands of the general manager, Mr. Bickel, who has been engaged in the enterprise throughout its entire career.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Iowa Telephone company has extended its wires to connect with Lancaster, Ia., on the line from Martinsburg to Sigourney.

Gifford Hoag has ceased to be manager of the telephone exchange at Red Oak, Ia., to become manager of the Fort Dodge, Ia., exchange. He is succeeded at Red Oak by O. R. Cole of Creston.

The Board of Aldermen in St. Paul has passed resolutions granting the Mississippi Valley Telephone company the right to construct conduits and erect poles under its franchise for a long-distance exchange.

The Fountain City Telephone company has extended a line to Bohri, Wis., from Fountain City. Mr. Huefner of Fountain City has extended lines from Pine Creek and Arcadia to Bohri.

The Wisconsin Telephone company has served notice on the city of Sheboygan, Wis., that the case against the company must either be tried on its merits or dismissed. The company's right to do business in Sheboygan hinges on the outcome. The City Council went at the matter energetically at first, but later let the matter rest, and the company wants matters brought to a head.

The Union Telephone company has bought a controlling interest in the Southwestern Telephone company at Dodgeville, Wis., and will proceed to make a number of improvements in the service. Connection with a number of surrounding towns will be made.

The Board of Public Works of Des Moines, Ia., has addressed the telephone and telegraph companies and asked them to unite in the use of poles in the alleys of the downtown districts.

The Ottumwa, Ia., Long-distance Telephone company has been incorporated, with $10,000 capital stock.

The Wisconsin Telephone company has begun work on a long-distance line between Ashland, Hurley, Ironwood and all the towns on the range. It is expected to have the line in operation by the last of October.

The telephone company at Madison, Wis., is drumming up subscribers, with a view to putting in a switchboard of larger capacity. The company is said to have 800 subscribers.

The Minnesota Central Telephone company has about completed its line between Montevideo, Minn., and the Twin Cities. According to a report from the office of this company at Willmar, Minn., the transaction with the Northwestern Telephone Exchange company amounts to an exchange of lines, by which each company agrees to confine itself to a certain territory, and not infringe upon the other's. The Minnesota Central company claims to have the Northwestern's line to the Twin Cities and the branches.

The new telephone exchange at Luverne, Minn., has been completed and put in operation. Day and night service will be given.

The Mississippi Valley Telephone company has connected its Minnesota system with that of the Dakota Central Telephone company of Aberdeen, S. D. This gives connection with 1,000 miles of wire and covers South Dakota and many points in Nebraska.

The new telephone exchange at Wheaton, Minn., has been completed and is ready for operation.

The Southwestern Minnesota Telephone company is about to build a line from St. James, Minn., to Windom.

A telephone line is talked of along the Moorhead Northern, from Moorhead, Minn., north.

A committee of the council of Duluth, Minn., is preparing an ordinance for telephone companies. It provides for competitive bids for a franchise, on the basis of the payment of a percentage of earnings to the city and the fixing of maximum rates for telephone charges.

The Standard Telephone company is preparing to connect with Preston, Minn.

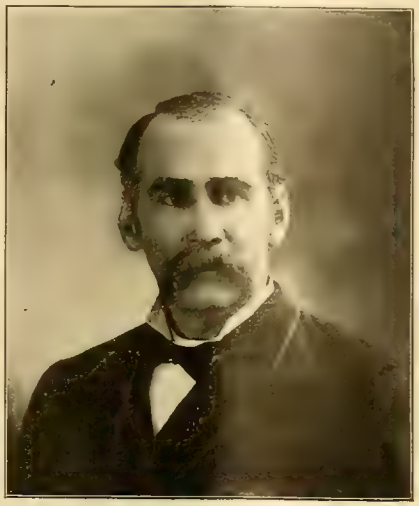
J. H. McFarland has secured a franchise to erect and maintain a telephone line in Tulare County, Cal.

The Statist of London has made elaborate calculations to find what it would cost the British government to purchase the National Telephone company's system outright and immediately. The amount arrived at is £6,566,442. It is further calculated that in the 13 years to elapse before the rights of the company expire in 1911 the government would make a profit of £4,732,000.

Illinois Telephone Association.

The meeting of the Illinois Telephone association at Du Quoin, Ill., on Wednesday and Thursday of next week will be marked by the reading of several papers on practical subjects by H. J. Hertz of New York, H. P. Clausen of Chicago, J. J. Nate of Madison, Wis., S. A. Dinsmore of Chicago, and others. There is to be a banquet at the St. Nicholas Hotel, and a number of exhibits are expected.

Portraits of the president and secretary of the association are given herewith. Dr. I. A. Lumpkin, the president, is a resident of Mattoon, where he is president of the Mattoon Telephone company. This company was organized by Dr. Lumpkin and J. W. Gay in August, 1894, and erected the second independent plant of considerable size in the state in



DR. I. A. LUMPKIN, PRESIDENT ILLINOIS TELEPHONE ASSOCIATION.

the spring of the following year. The growth of the business has exceeded the most sanguine expectations of its promoters. The company has now 375 telephones in use and is giving excellent service. Last year Dr. Lumpkin was elected the first president of the Illinois Telephone association, and he has since been re-elected without opposition. He has been a member of the executive committee of the Independent Telephone Association of the United States from his state ever since the formation of the national organization. Dr. Lumpkin is also president of the Eastern Illinois Telephone association, and he has held several offices in the dental societies of the state.

Albert M. Howell, the secretary of the Illinois

ALBERT M. HOWELL, SECRETARY ILLINOIS TELEPHONE ASSOCIATION.

Telephone association, hails from Hillsboro. He is a modest young man but a capable official.

The meeting should draw out a good attendance, and it is earnestly hoped that as many independent telephone men as possible will make it a point to be present.

The headquarters of the People's Telephone and Telegraph company have been removed from Allentown, Pa., to Columbia. It is the intention of the People's company to construct a line to Elizabethtown to connect with the line of the Columbia Telephone company, which will open communication between Columbia and Lebanon. The officers of the company are: President, H. C. Young of Columbia; secretary, A. W. Gieskie of Columbia; treasurer, M. R. Hoffman of Marietta.

Noise Indicates Waste.

We all recognize noise as more or less of a nuisance, but many of us make the mistake of going no further and realizing that it is nearly always a protest against misplaced and wasted energy, say The Engineer. As a matter of fact, there is no surer indication of waste of power than the presence of noise. The creaking wheel, the grating lock, the screaming car flange, all tell of energy exerted to overcome useless resistance and loudly protesting meawhile against such abuse. Who has not heard the shrill cry of the planer as the badly designed or imperfectly adjusted machine permits the open belt to get onto the driving pulley before the crossed belt has left it? That shriek costs money every time the reversal is made, and the noise is a fair measure of the waste.

Again we hear some laboring steam pump forcing against a heavy head of water; carrying steam at high pressure and full stroke. Each stroke ends with a "bark" almost like the blow of a trip-hammer, and it needs no indicator diagram to tell the hearer that great waste of power is going on. The noise is not only unpleasant to hear, but it is costly to produce, and 200 pounds of steam to do the work of 40 is the tale it tells to him who can understand the language.

It is indeed true that mechanical operations cannot be conducted without noise, but that is only evidence of the imperfections of the processes. The old-time boiler shop resounded with the blows of the hammers of the riveting gang, and to the uninitiated it seemed as if the men who were making the most noise were doing the most work. To-day the hydraulic riveter does more and better work than all of them together, and is silent and efficient as well.

The quiet hydraulic forging press is superseding the noise-producing hammer; the noiseless electric current is replacing the flapping belt, and everywhere in machine shop and factory the elimination of noise is being accompanied by an increase in efficiency which is grateful to ear and purse alike.

One feature about noise in mechanical operations has its use, however; that is in the diagnosis of disorder. Just as the physician applies the stethoscope to hear the abnormal sound in the chest of the patient, so the skilled engineer "looks with his ears" when searching for the source of derangement in plant or machinery. Any unusual sound should always be considered an indication of disorder, which if not soon detected, may become disaster, and the synchronism of the sound with the revolutions of of a shaft or the vibrations of a rod may often lead to the detection and location of the trouble in time to prevent serious injury.

The cautious cyclist knows very well the importance of investigating any unusual clicking about his machine as he spins along the road, and his ear soon tells him whether the sound "times" with the revolutions of the crank or of the wheels, and helps greatly to tell him just where the loose screw may be found.

It is not only in the machine shop, or in strictly mechanical devices, that the wastefulness of noise may be found. The rumbling cart, as it passes over the rough cobblestone pavement, tells the story of brute force wasted in the overcoming of useless resistance, just as the silence of the pneumatic tire, rolling upon the smooth asphalt, indicates the high degree of efficiency.

We cannot do without noise altogether as yet, but at least we may recognize that noise means waste, and that the well-designed device makes the least amount of noise which the conditions of its operation will permit. Many of the old noises of mechanical and industrial operations have been banished, and many more ought to be.

Aluminum as an Electrical Conductor.

A correspondent of the Electrical Review of London, V. Zingler, writing of the relative costs of copper and aluminum, states the case of the latter metal briefly:

"I do not think any claim is put forward for insulated aluminum wires, but for bare aerial transmission purposes the following advantages may be pointed out:

"(1) For equal conductivity aluminum is half the weight of copper.

"(2) For equal conductivity aluminum has about the same breaking strain as copper—if not more.

"(3) Therefore for equal conductivity the spans may be about double those with copper wire.

"(4) For equal conductivity with aluminum at 29 cents per pound the cost is nearly the same as copper.

"It is thus evident that with aluminum wire for equal conductivity there is a great saving in carriage, labor, posts, insulators and upkeep. The difficulty of joints is an artificial one, as there are plenty of good mechanical joints. A great deal of unnecessary fuss is also made about 99 per cent. and 100 per cent. purities. How often are these verified?

"Finally, as regards price, everyone knows the reason of the high price of aluminum in England; but the Americans offer to deliver the wire at Liverpool for export at 29 cents per pound. It is unnecessary to point the moral."

Dickinson, N. D., has an electric-light plant in prospect as soon as the town can incorporate it.

Comparative Earnings and Economy of Operation Between Single and Double-truck Cars for City Use.

By Richard McCulloch.

Part II.

Wear and Tear on Trucks.—It is evident that since a car equipped with double trucks has eight wheels and one equipped with single trucks has four, the former will be the more expensive to supply with wheels. Table I. shows the comparative replacement cost of wheels and brake shoes on the two roads for one year. Table II. shows the comparative cost of maintenance and repairs of trucks and motors for two years. It will be noted that while the cost per car is much greater on the road using double trucks, the cost per passenger is almost the same. It would not be fair to assume from these figures that the cost of maintenance of trucks and motors per passenger is always the same, no matter what sort of truck is used, because these figures result largely from the fact that in this particular case the double-truck car carries the greater number of passengers; but an inspection of the table will emphasize the advantage of the large unit as compared with the small one. It will be seen by a reference to table I. that the greater part of the increased expense of maintaining the double trucks is due to the renewals of wheels and brake shoes.

In examining the relative strength of the various parts of trucks, the side pieces may be compared to a beam supported at two points and carrying a concentrated load. The deflection of such a beam is proportional to the third power of the span, and in the analogy the span corresponds to the wheel base of the truck. Therefore, the shorter the wheel base the stiffer the truck side, and in view of its long wheel bases, it is evident that the single truck is at a disadvantage in this respect. For instance, a truck side where the wheel base is four feet and six inches is 3.76 times stiffer than a truck side of equal section where the wheel base is seven feet.

Wear and Tear on Motors.—Table II., to which reference has already been made, gives the comparative expense of inspecting, repairing and maintaining the motors of double and single-truck cars. As in the case of the trucks, it will be noted that while the expense per car is much greater in the case of the double-truck car, the expense per passenger is nearly the same.

Table IV. gives the relative weights carried by the different cars, when empty, seats full and car crowded. It will be noted that while the percentage of weight available for traction in the case of the maximum traction truck remains constant, in the case of the motor and trailer it falls off as the number of passengers increases and is especially small if the trailer is proportionately more heavily loaded than the motor car.

Power Required.—Table III. gives the power required to operate the different cars, and is the average of a long series of wattmeter tests. In making these tests the wattmeter was placed on a car in actual service and allowed to remain through the entire day. An examination of the tables will reveal the fact that the power required for the propulsion of the car and the care and repairs which the motors demand are much greater in the case of the double-truck car. But if the number of passengers be taken into account, it is seen that the power and the cost of maintenance are roughly proportional to the number of passengers carried with either style of truck.

Wear and Tear on Track.—The wear of the rails of a street-railway track is due to the grinding action of the wheel on the rail, and this is proportional to the weight on the wheel, but is intensified by the dirt on the rail, which causes the wheel to slip and acts an abrasive agent after the slipping has begun. The weak point of a street-railway track, however, consists of the joints and the openings in the special work. The energy of the blow which the wheel strikes as it passes a low joint or a crossing is equal to the product of the weight of the wheel and the height of the drop. Therefore, on any given track both the wearing action and the destructive action of the wheel are proportional to the weight which rests upon it. If the number of wheels under a car be increased, the number of blows which a low joint receives is also increased, but the intensity of each blow is diminished. Double trucks are at no disadvantage as compared with single trucks in this respect, unless the weight of the car be increased. Due to the shorter wheel base, double trucks go around sharper curves and go around the same curve with less output of power and less wear on the rail than single trucks. The double truck fell into disrepute when the maximum traction truck was first exploited on account of its liability to leave the track. This was due to the small amount of weight which was placed on the small wheels. It is now customary to place 30 per cent. of the weight on the small wheels, and with track in fairly good condition, no difficulty is encountered in keeping cars on the track.

The Use of Trailers.—In the case of the two roads under discussion, the road operating single-truck cars attaches trail cars to the motor car for two trips in the morning and two trips in the afternoon. For the entire year trailers were operated on 26 per cent. of the trips. Allusion has already been made to the use of trailers. The advantage of the trailer on this particular road arises from the fact that the load peaks are unusually sharp. The use of the trailer increases the capacity of each unit during the heavy hours of morning and evening travel and during rush travel due to baseball games and races. On this particular road the motormen and conductors are paid 10 cents per trip extra for all trips where a trailer is attached to the motor car. This expense largely offsets the value of this arrangement. There is no question that the use of the trail car increases the number of accidents for two reasons; first, because the trailer is another car, and second, because the opening between the motor and trail car is a dangerous one for a passenger boarding or alighting from the car. It is impossible to estimate the money value of this accident liability, because in the case of many accidents it is difficult to determine what proportion of the damage was due to the trailer. Trailers must be switched at the ends of the roads and at the car sheds, and require men and horses for this purpose. The use of trailers also entails other expenses, such as car heating, cleaning, repairing and car license, which should be charged against the trail-car system. To counterbalance all these disadvantages, the only advantage which the trail-car system possesses is its flexibility.

The Seating Arrangements, Exits and Entrances.—As has already been stated, the cross-seat is used almost so universally in connection with the double-truck car that it is fair to consider the economy and efficiency of cross-seats and longitudinal seats in connection with the discussion. There is no doubt that the cross-seat is preferable from the passenger's standpoint, and the reasons for this preference are not difficult to analyze. Passengers often travel in pairs, and the cross-seat gives a privacy to the conversation which is not possible with the longitudinal seat; the jerks due to the stopping and starting of the car are less disturbing to the passenger when he is seated facing the direction of motion, and the cross-seat renders it easier to look out of the windows.

If two car bodies of the same size are taken and cross-seats installed in one and longitudinal seats in the other, the car body equipped with the cross-seats will have the narrower aisle. This induces two disadvantages in the cross-seat car—one, that the crowded capacity of the car is less, and the other, that when the car is crowded the time consumed in

TABLE I.

Comparison of the cost of wheels and brake shoes on Double and Single Truck Cars for the year 1897.

	Average No. of Wheels used per car per year.			Cost per car per year.				Total Cost per car per year per 1000 passengers	Wheel Mileage.	
	33″	30″ Trailer.	24″	Wheels.	Labor in Replacing.	Brake Shoes.	Total.		33″	24″
Double Truck Cars (47)	8.72		7.06	$77.92	$17.36	$11.70	$106.98	$0.47	17260	20916
Single Truck Cars (70)	6.26	1.00		$40.93	$7.99	$4.30	$53.22	$0.38	25329	

The Double Truck Car has four 33″ wheels, four 24″ wheels, and eight brake shoes.
The Single Truck Car has four 33″ wheels and four brake shoes.
Average daily car mileage—115.

TABLE II.

Comparison of the cost of repairs and maintenance of trucks and motors on Double and Single Truck Cars for the years 1896 and 1897.

	Average passengers per car per year.	Truck Repairs.		Motor Repairs.		Total.	
		Per car per year.	Per car per year per 1000 passengers	Per car per year.	Per car per year per 1000 passengers	Per car per year.	Per car per year per 1000 passengers
Double Truck Cars (47)	226000	$181.00	$0.80	$319.00	$1.41	$500.00	$2.21
Single Truck Cars (70)	141000	$110.00	$0.78	$196.00	$1.39	$306.00	$2.17

G. E. 800 motors on Double Truck Cars.
W. B. 50 motors on Single Truck Cars.

TABLE III.

Comparison of the power required by Double Truck and Single Truck Cars.

	Average Watts.	Average Watt-hours per car mile.	Average Speed. Miles per hour.	Average Watts per seat capacity.	Average Watts per ton (car empty).	Average Watt-hours per car mile per 1000 passengers.
Double Truck Car. Seats 36—Weight 11.75 tons. Average for the entire day.	12040	1334	9.03	335	1025	5.9
Double Truck Car. Seats 36—Weight 11.75 tons. Average for the heaviest trip.	13080	1412	9.25	335	1025	
Single Truck Car—no Trailer. Seats 28—Weight 8 tons.	8471	921	9.20	303	1060	
Single Truck Car. Trailers operated 26% of the time. Average for the entire day.	9400	1110	8.42	254	1088	7.9
Single Truck Motor and Open Trailer. Seats 63—Weight 10.5 tons. Average for the heaviest trip.	12680	1440	8.84	201	1208	

TABLE IV.

Comparison of weights carried by Single and Double Truck Cars.

	No. of Seats.	Total crowded capacity.	Weight empty.	Percentage of weight on driving wheels.			Pounds weight per seat.			Pounds weight per unit of total capacity.		
				Car empty.	Seats full.	Car crowded.	Car empty.	Seats full.	Car crowded.	Car empty.	Seats full.	Car crowded.
Single Truck Motor Car.	28	80	16000	100	100	100	572	702	943	200	246	330
Single Truck Motor Car with open trailer.	63	140	21000	76	67	67	334	463	622	150	210	280
Single Truck Motor Car with closed trailer.	48	125	21000	76	72	71	438	568	776	168	218	298
Double Truck Car.	36	110	23500	70	70	70	653	782	1050	214	258	344

Note.—Each passenger is estimated at 130 lbs.

loading and unloading is increased. The latter difficulty will be the more serious the shorter the haul and the greater the number of stops.

In the early days of the double-truck car it was customary to mount the body high enough so that the wheels would swing under it. This gave the car a very unsightly appearance and made it difficult of access. Three steps were necessary to reach the platform, and as these steps were steep, this form of car was particularly objectionable to ladies. By the use of the maximum traction truck with 33-inch wheels, however, it is possible to lower the floor to within 37 inches of the rail. By dropping the platform eight inches below the floor of the car, it is possible to reach the platform by the use of a single step 14 inches above the rail. This renders the car as easy of access as the single-truck car. In the opinion of the writer, the fact that the car floor may be made so low in double-truck cars is the chief advantage of the maximum traction truck.

It has been attempted to facilitate the loading and unloading of large cars by providing exits and entrances other than the rear door. This practice, however, brings about what is perhaps a more serious disadvantage, as it gives the conductor more than one door to watch, renders it difficult for him to keep track of his fares and increases the liability of his starting the car before a passenger is on or off.

The Preference of Passengers.—The preference of passengers, to which allusion has already been made, is undoubtedly in favor of the double-truck car. In cities where the entire street-railroad system is controlled by one company, this point may not be considered of value, because passengers are obliged to ride in whatever conveyance the company chooses to furnish. However, the experience of roads which have changed their rolling stock from small, single-truck cars to large, comfortable double-truck cars is that the travel has shown an immediate increase. Part of this increase has been drawn from parallel roads, but part has been a created traffic. As the accommodations increase, more people ride, and the regular patrons ride oftener. The street-car ride, instead of being regarded as a necessary evil, comes to be looked upon as a pleasant part of the shopping expedition, the visit or the picnic. How great this created traffic will be depends upon the class of patrons served by the road and upon the terminal facilities of the line. The extremes of society, the very rich and the very poor, are not good riders, and it is probable that a road serving either of these classes entirely would get very little return for additional accommodations. The greatest increase would come from those who are now the best patrons of the street railroads, the fairly well-to-do middle class.

In this paper the writer has not attempted to prove that either the single-truck or the double-truck car is the better type. He has merely attempted to discuss the subject, to bring out the strong points and the weak points of each type in such a way that the results may be applied to special and local conditions. Outside of the question of economy of operation, there are few roads on which the use of attractive, easy-riding, double-truck cars would not create a pleasure travel, especially in the summer season. In a general way it may be stated that the single-truck car is more suitable for short hauls, dense traffic, many stops and low speed. On the other hand, the double-truck car is more suitable for long hauls, high speed, few stops and pleasure travel. In the existence of either extreme condition, it would not be difficult to decide which car to use. It is in dealing with intermediate conditions that the manager must use his judgment.

Discussion.

Mr. McCormack, Brooklyn: Mr. McCulloch states in the paper that with the use of double-truck cars it would be possible to lengthen out the headway. I wish to state that on our heavy lines we have had between three and four hundred double-truck cars and in not a single instance have we been able to lengthen out the headway. The double-truck cars increase the patronage to such an extent that we have had to shorten the headway. In relation to standing loads and moving crowds, I noticed yesterday (Labor Day) that on the cars seating 40 pasengers going to Coney Island the average was 65 on the register. With a double-truck car and a seating capacity of 60, it is nothing unusual to see 128 and 130 on the register, so you can see, when you want to move large crowds, what the difference is with a double-truck car compared with a single-truck car. There are 178 double-truck cars running in the service on one line, and you can imagine what the travel is on that line.

Mr. Dimmock, Council Bluffs: What is the headway?

Mr. McCormack: The headway on the Court street line, running from New York direct to Coney Island, is less than a minute. On the Third avenue line it is three minutes nearly all day, and part of the time two minutes. The headway from Sixty-fifth street to Coney Island, where all the Coney Island cars converge, is about 20 seconds.

Mr. Sloan, Chicago: The double-truck cars are certainly coming into practice and favor, and it seems to me the main question is the question of traction. I have had no experience with double-truck cars and I would like to know whether anyone who has had experience with them knows anything about the motors—the use of four motors instead of two to get the maximum traction. It is a subject we should know more about, because in the use of the double-truck cars we are replacing the two motors with four.

Mr. Beggs, Milwaukee: I think Mr. McCulloch has so thoroughly presented the case that there is very little to be said upon it, particularly in behalf of the plaintiff. I do not think that the writer of the paper evinced any partiality as between a single and double-truck car; but it is very evident in what direction the sympathies of the writer of the paper lie. In the city of Milwaukee we have for three years been experimenting practically with the advantages and disadvantages of single and double-truck cars. In 1896 there was put upon the system 20 double-truck cars. These cars were equipped with 18 double seats, seating 36 persons. A year ago, the early part of 1897, in view of our experience of a year in the use of the cars we enlarged somewhat upon them and improved them to some extent, we thought. We increased the length of the car and seat 40 passengers, by placing in double seats. During the present year we have benefited by our experience still further, and we have again increased the length of the car—that is, the body—and enlarged the seating capacity, without increasing the over-all length at all, which is 41 feet, over bumpers, and maintain virtually the same size of platform, so far as the accommodation of passengers is concerned in crowds, by increasing the length of the body one foot, slightly moving the seats together and reducing the amount of the bumper in front of the dash. We seat 44 passengers, having 22 double seats.

Of course the question as to the use of the double-truck car is determined by local conditions. Our double-truck cars, for the climate of Milwaukee, are to a great extent a necessity. Because of the large open spaces and our short summer season, it is almost impracticable to maintain the duplicate equipment necessary for summer and winter service. I do not know anyone now in the service of the company who has not been converted to the use of the double-truck car, and we have arrived at a standard. There are many reasons existing for the adoption of a standard car with us—the short summer season, the likelihood of chilling winds or cold rains coming up at any time in the warmest days of summer, and others. We now have a car that suits us 12 months in the year. We have not had any difficulty with the matter of traction. We use a 33-inch wheel in the present equipment we are having built, and still maintain only a distance of 32 inches from the rail to the bottom of the sill. That was one of the difficulties we had to overcome. We did it by giving considerable attention to the matter of the construction and framing of the car to permit the 33-inch wheel to readily pass around our shortest curves. We are so thoroughly convinced of the advantages of the double-truck car that we are gradually permitting all our single-truck cars to be worn out and scrapped as their life is brought to an end.

We have found that the use of the double-truck cars has greatly increased the traffic; in other words, the people would wait for double-truck cars on certain lines. We are compelled to place some of the single equipments on at times, but the people will wait on the streets, where the two types of cars are run on the same lines, for the double-truck car, for the reason that the riding is much more comfortable. The double-truck cars on our lines ride almost as smooth as a Pullman sleeper. That, of course, depends largely on the character of the track; but on a large portion of our lines, particularly on those lines where we are putting on the heavy equipment, we are having the connection between the rails cast-welded at the joints and we are doing away with the rocking and pitching motion of the car, and are enabled by the use of the double truck to make much higher speed, and that is the tendency of roads all over the country. We have to make higher speeds. We have brought our average up within two years certainly a mile an hour. Our average speed now is somewhat in excess of nine miles per hour. We would not be able to do that with a single-truck car, because of the oscillating motion and the liability of the pitching to displace the trolley wheel, whereas with the double-truck cars we seldom have such an experience.

As to the matter of wear and tear, we believe the weight of the evidence is in favor of the double-truck car. While we have doubled the number of trucks and doubled the number of wheels to maintain, the blow on the wheel at crossings and special work is so much easier that it does not wear the trucks nearly so much, and we find that our repairs of springs is possibly 75 per cent. less on the double-truck cars than on the single-truck cars. We have been able on our lines (and I of course recognize the difference of conditions between Greater New York and our less populous cities) to increase our headway on most of the lines on which we have placed the double-truck cars. In other words, we try to regulate the headway of the double-truck cars to meet the general conditions during the larger portion of the day, and during the rush hours in the morning and evening, particularly in the evening, we either shorten the headway one-half or throw in intermediate cars, but still maintaining the regular headway of the regular equipment of the line, so that, so far as the city of Milwaukee is concerned, we are strongly impressed with the great advantages of the double-truck car, many of which have been referred to indirectly in Mr. McCulloch's able presentation of the case; and we experience other advantages, which are governed by local conditions, and would not apply possibly in all cities even of the same population.

A question was asked as to the four-motor equipment. I might say that during the present year we have had 10 interurban cars constructed, running between Milwaukee and Waukesha Beach and the city of Waukesha, a distance of 20 miles or slightly in excess. These cars were carefully constructed after complete investigation and the possession of all information we could get from electrical engineers, and, based on this and our own experience and judgment, we have equipped them with four motors, geared to make 20 miles per hour, weighted with 40,000 pounds. Our double-truck cars are possibly the heaviest in use anywhere in the United States. They weigh about 35,000 pounds. With these four-motor equipments we have no trouble from lack of traction whatever, and we are beginning to believe that in the very near future it will be advantageous for us to equip all the double cars with four motors. We have some grades we are climbing with our double-truck cars, running as high as six and seven per cent. They do it with a little difficulty at certain times, with certain conditions of rail and weather; but with our four-motor equipments we have no difficulty whatever in climbing the grades, and in getting, we believe, very superior service.

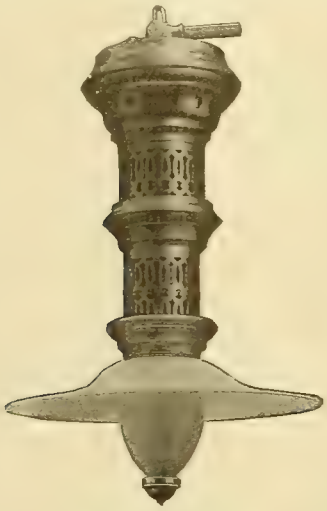
I think that the case of the plaintiff, which Mr. McCulloch has been pleased to term the double-truck car, was so ably presented in his paper that it does not need any other advocate. I should rather have denominated the double-truck car the defendant, because there have been so many attacks made upon it. I can only say, so far as we are concerned, in the city of Milwaukee, the double-truck car has come to stay. The character of the population you are serving has much to do with the discrimination that is shown in the selection of a car to ride in. Some sections of the city do not pay much attention to it, and there are other sections that discriminate, and just as you please the pleasure and comfort of riders, we find the traffic increases on those lines. We have what we might call a mechanic district in our city, which uses our Third street line, which was equipped during the present year, and there is a marked increase on that line. I might say, as indicating the economy of the double-truck, that on certain lines equipped two years ago with the double-truck cars, we had previously maintained a headway of 4½ minutes, and by the use of the double-truck car and the greater speed obtained, together with the greater number of passengers accommodated, this line running through the better portion of the city, we have been able to gradually lengthen out the headway to six minutes without any complaint from our patrons. You can readily understand what that means in reduced equipment. Quite recently, within the last three months, by a further increase in the speed, on a long line (our policy is to run long lines from one extreme of the city to the other, for the comfort of the pasesngers and to avoid transfers), we have cut off another car and still maintained the same headway of six minutes, by increasing the speed and making the trip in 90 minutes instead of 96 minutes. I might say that in the same way on the Third street line, the line last equipped, we hope by the increased speed that we will be able to maintain, by the use of these double-truck cars, over the oscillating single-truck cars, we will be able to take off two of the 16 cars on the line and reduce the number to 14. This is one of the very great economies which we are realizing throughout the system by the use of these double-truck cars. We are able to run at very high speeds on our line from Milwaukee to Waukesha with these double-truck cars, whereas with a single-truck car it would be hazardous to run the car at such speeds and they could not be kept on the track. The experience of the city of Milwaukee is strongly in favor of the double-truck car. The latest improved truck permits us to use the 33-inch wheel, with the same facility as the 30-inch wheel, and with no greater height from the rail; and I think as soon as our necessities are known the manufacturers of trucks and cars will accommodate themselves to the new conditions and many obstacles will be overcome.

Great St. Bernard Railway.

A scheme has just been submitted to the Italian government asking for a concession to construct an electric railway of a total length of 70 kilometers, or 43½ miles, over the Great St. Bernard. The project, which is being promoted by an English company just constituted under the title of the Great St. Bernard Railway Concessionary company, has been placed before the Italian government by Mr. John B. Fell, engineer of Turin, who intimates that he has informed the president of the Swiss Federal Council of the intention to seek, both in Berne and Rome, a concession for the building of the line from the Italian frontier to Martigny, in the canton of Vallais. It is proposed to overcome the heavy gradients by the adoption of a third rail on the rack system, as used on the Mont Cenis line. The promoters of the railway intend to insure safety in working during the winter months by the adoption of precautions against the danger of snowfall and avalanches. The cost of construction and equipment of the railway, for which no subsidies are asked by the promoters, is estimated at 15,000,000 francs.

Miniature Arc Lamp.

The introduction of the enclosed arc lamp has extended the field of the arc system of electric lighting to interior illumination; the miniature arc of the General Electric company promises another advance in providing for the use of arc light in smaller units, so that it may compete with oil, gas and incandescent lamps in illuminating halls, offices, display windows and rooms of limited area.



MINIATURE ARC LAMP.

Heretofore arc lamps have been designed to give an intensely bright light, and they naturally required considerable current. For certain installations such lamps are not desirable. With low-ceilinged rooms an intense light over-illuminates the area directly beneath it while other parts of the room are left comparatively dark. In the new miniature arc lamp, illustrated herewith, the illuminating power and the current are much less, so that several lamps are not more expensive to operate than one large lamp, while by dividing the total amount of light required the general illumination is greatly improved. The miniature arc lamp is also suitable for other places where a large arc lamp would supply more light than necessary. It is of the single-globe and reflector type, the light of the arc being thrown down from the polished under surface of the reflector.

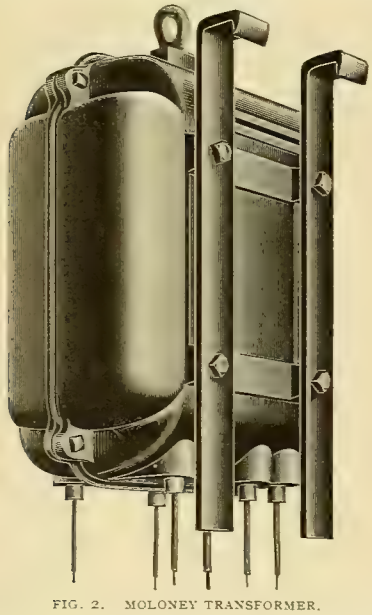


FIG. 2. MOLONEY TRANSFORMER.

The miniature arc lamp designed for 110-volt direct-current circuits is frequently required to operate at slightly higher or lower voltages. An adjustable resistance has, therefore, been provided in the top of the casing which adapts the lamp to any line voltage from 100 to 120. The standard current required by the miniature arc lamp is 2½ amperes, but a loop in the magnet coil permits an adjustment for three amperes; 73 to 75 volts is required at the arc, and, when adjusted for 2½ amperes with a line voltage of 110, the energy at the terminals is 275 watts. Adjusted for three amperes the energy is 330 watts. The life is from 40 to 45 hours with standard current and from 35 to 40 hours with three amperes.

FIG. 1. MOLONEY TRANSFORMER.

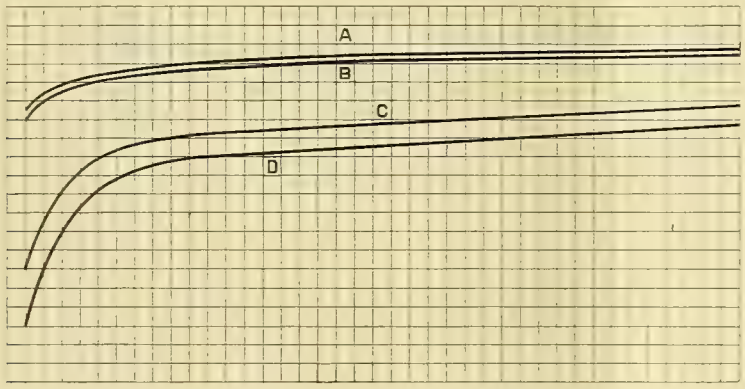


FIG. 3. MOLONEY TRANSFORMER.

The mechanism of the miniature arc lamp operates on the well-known General Electric carbon-feed principle. The carbon is fed through a brass tube extending through the center of the magnet coil. The double cam clutch, which operates directly upon the carbon, is simple in its action and has few parts. Special attention has been given to the design of the carbon holders and the general arrangement of the frame to facilitate rapid trimming.

The principal dimensions of the miniature arc lamp are:

Length over all	18¼ inches.
Weight	9¼ pounds.
Upper carbon	5½ by ⅜ inches.
Lower carbon	3½ by ⅝ inches.
Enclosing globe—Top diameter	2 inches.
Maximum diameter	3 inches.
Bottom diameter	1⅞ inch.
Height	4 inches.
Porcelain shade	11 by 2 by 2⅝ inches.

No outer globe is used. Each lamp is arranged with a switch so that it can be readily thrown in or out of circuit.

Lap-welded Speaking Tube.

In the electrical supply business speaking tube has been so closely associated with electrical signaling devices—bells, annunciators and similar apparatus—that it has been considered one of the necessities for a well-stocked concern. The Western Electric company has manufactured speaking tube for a number of years, and a special feature of its speaking tube is the lap-welded seam, which is practically air-tight and assists in making the speaking tube rigid and strong. The cut indicates the seam and the manner of making it. The best grade of tinned sheet-iron, known as I. C. tin, is used in the manufacture. The sheet tin is thoroughly uniform, and the tube when finished is not only uniform in regard to the character of the material, but also uniform in shape. Another feature is the careful manner in which the speaking tube is packed, 200 pieces being put in a crate, which weighs, approximately, 152 pounds. The 200 pieces are equal to 1,000 feet. The size of the crate is 13¼ by 17¼ inches, and it is five feet 3½ inches long, being a convenient size both in weight and shape for one man to handle.

LAP-WELDED SPEAKING TUBE.

Moloney Transformer.

The accompanying cuts (Fig. 1 and 2) illustrate the type A transformer made by the Moloney Electric company of St. Louis. Fig. 1 shows the general appearance of the device and Fig. 2 gives a rear view, showing the method of attaching the transformer to its support. In Fig. 3 relative efficiency curves of the transformer are given. Curve A indicates the maximum efficiency at 133 cycles; curve B, maximum efficiency at 60 cycles; curve C, all-day efficiency at 133 cycles; curve D, all-day efficiency at 60 cycles.

It is claimed that this transformer has been carefully designed to cut down the iron losses to a minimum and to secure close regulation. The maximum all-day efficiency has been increased, it is said, "to a degree without precedent in the history of transformer building." The mechanical construction and insulation are claimed to be of the best, and the transformer is guaranteed against aging deterioration for two years.

CORRESPONDENCE.

New York Notes.

New York, September 19.—A reminder of last spring's electrical exhibition is found in the action brought in the Supreme Court by Max Meyer to recover $10,000 damages from the United States Electrical Supply company, which he seeks to hold responsible for the loss of his whiskers and also the hair on the right side of his head. Meyer was engaged by the company for the show in Madison Square Garden last May. He had charge of the X-ray exhibit, and handled the fluoroscope. After about 10 days he says that he felt a peculiar itching sensation all over the right side of his body. He thought nothing of it at first, but he became alarmed when his face began to shrivel, and his hair, mustache and beard on the right side to drop off. Then he says his arm began to pain him and to swell up. He went to his physician, who, after a thorough examination, told him, it is claimed, that the right side of his body had been cooked. He at once left the employment of the electrical company. He thinks the company is liable in damages because no warning was given to him of the danger that he incurred in exhibiting the X-rays. Meyer has had several photographs taken of his face and body since then and compared with photographs taken before his employment. They will be used in the trial of the case.

The General Electric company's new common stock, $18,276,000, issued in place of the old common and preferred stock of the company, which has been reduced in accordance with the recent action of the stockholders of the company, was listed in the Stock Exchange on Wednesday of last week.

A delegation from the Central Labor Union called upon President Guggenheimer of the council a few days ago and had some talk with him over the complaints made of the high steps of street cars. The delegation told him that there was great danger to passengers from the present high steps of the cars. The delegation said afterward that Mr. Guggenheimer was preparing an ordinance which he would submit to the council and to the Board of Aldermen. It will provide that the steps shall not be at a dangerous height, and that cars must be stopped when signaled. Mr. Guggenheimer may be prevailed upon to make some valuable engineering suggestions by which the steps may be avoided, as he comes fresh to the problem and is not impeded by the experience of years, as is the case with the engineers of the street-railway companies.

The Western Union's report for the third quarter of the year shows a decrease in revenue of $150,000 as compared with the corresponding period of last year.

The Edison Electric Illuminating company of Brooklyn has declared a quarterly dividend of 1½ per cent., payable October 1st.

There is a persistent rumor that the Metropolitan Street Railway company, with its big plants and elaborate underground construction, is preparing to go into the electric-lighting and steam-heating business. According to another story, the company has entered into a combination with the electric-lighting companies which will enable the latter to offer their product at a greatly reduced rate. At the office of the Edison Electric Illuminating company it was said that nothing whatever was known of such a combination. The officials of the Metropolitan Street Railway company deny that their conduits are to be used for anything other than street-railway purposes. "We have our hands full running a railroad," said an official. "This report appears periodically, and is probably due to the fact that people have an idea that the new system requires nothing more than was needed for the one-line overhead trolley. The whole thing was gone over satisfactorily a year ago, when the Railway Commission was in session. They had their own engineers make an examination, and it

was shown that the various ducts were necessary for the system we are to use."

Bridge Commissioner Shea served notice on the Police Board at its meeting last week to the effect that the trolley companies are violating their contract by running cars over the Brooklyn bridge within the contract distance of 102 feet. Each car, according to the contract, must be 102 feet or more behind the car ahead of it on the bridge. Chief Devery was instructed to order the policemen on the bridge to see that the rule was no longer violated.

The combination car on trial in Brooklyn fails to please the New York Tribune, which lifts up its voice to say: "The new street cars in Brooklyn which some maladroit genius has imposed upon that long-suffering borough are supposed to be a compromise between open cars and closed cars, and to be available for use all the year round. As a matter of fact, they unite in themselves the bad qualities of both and the good qualities of neither, and are not fit for use at any time. In summer they are hot, in winter they will be cold, and for 52 weeks in the year they are bound to be stuffy, draughty, awkward to get into or out of, uncomfortable to ride in, and altogether abominable." M. S.

Northwestern Notations.

Minneapolis, September 19.—John F. Calderwood, auditor of the Twin City Rapid Transit company, Minneapolis, was elected president of the National Railway Accountants' association, recently in convention in Boston.

A new engine has been ordered for the electric-light plant of Long Prairie, Minn.

The John T. Burke Electric Supply company of Omaha was the lowest bidder for furnishing an electric-light plant for Wayne, Neb., at $5,200.

Benton & Sons of La Crosse, Wis., have the contract to furnish a 1,000-light dynamo for the electric-light plant in Lansing, Ia.

Thomas Morris, a lineman for the Electric Light and Waterworks company at Chippewa Falls, Wis., received a shock while on a ladder, and fell 18 feet to the ground. He fractured his collarbone and received a number of bruises.

The Wisconsin Central Railway company has secured an injunction preventing the Chippewa Valley Electric Railway company from building on a right-of-way claimed by the railroad company, between Eau Claire and Chippewa Falls, Wis.

Extensions and improvements to the electric-light station at Reedsburg, Wis., will be made, to cost about $2,500.

It is reported that the local creditors of the street-railway company of Dubuque, Ia., contemplate forcing the company into voluntary bankruptcy, and unless this is done they will make application for an involuntary bankruptcy.

A hook-and-ladder truck collided with a street car in Duluth, Minn., killing one man. The coroner's jury held the motorman of the car responsible for neglecting to see that the cross street was clear both ways before crossing.

Mayor Wood of Greenwood, B. C., is putting in an electric-power and light plant at Boundary Falls, B. C. The plant will have 500 horse power.

The street-railway company of Spokane, Wash., proposes to build two new lines, and has ordered materials for the purpose.

The waterworks company of Oshkosh, Wis., claims its pipes are suffering from electrolysis from the current escaping from the Citizens' Traction company's tracks. A section of water-pipe, taken from beneath a switch, is exhibited to show the effect of electrolysis. The electric company comes back with a section of pipe, taken up before the city ever had a street car, which shows the same kind of breaks, and claims the trouble to be that the pipes are soil-eaten.

Mayor Bouza has put in an electric-light plant at Tyndall, S. D.

F. S. Fell, manager of the Postal Telegraph company's office in Oshkosh, Wis., has been promoted to the Davenport, Ia., office. He is succeeded in Oshkosh by Miss Jennie M. Chase.

J. B. Canterbury of La Crosse, Wis., proposes an electric-car line in Mankato, Minn. He will apply for a franchise and proceed to form a company at once.

The Superior Rapid Transit company of Superior, Wis., is relaying its tracks on a broad gauge, and cars will soon be running through from Duluth.

Little Falls, Minn., has been having a contest with the electric-light and water company for a long time, over one subject or another. The city will vote on October 4th on $60,000 bonds to either purchase the present plants or build new ones.

The Commercial Light and Power company of Duluth is rearranging its wires to operate more economically when the city lights are reduced. The new contract with the city reduces the company's income about $30,000 annually, and rigid economy will be the order of the day.

Winnipeg, Man., has appointed an electric-wire inspector.

Marcus Johnson will put in an electric-light plant at Red Lake Falls, Minn.

The street-railway company of Butte, Mont., has withdrawn its request for a franchise to carry freight on its lines in Butte, and its manager says it was not the intention of the company to carry it on any but the back streets. Nevertheless, the application caused a great objection on the part of the citizens.

The projectors of the electric railway at Waupaca, Wis., say they will have the [illegible] operation by May 1, 1899. C.

Canadian Intelligence.

Ottawa, Ont., September 17.—Mr. J. W. Poupore, M. P. for Pontiac, is negotiating with an American syndicate, capitalized at $5,000,000, [illegible] smelters at Ottawa, and on the Georgian Bay, in connection with the Ottawa ship canal. In relation to this, a gentleman is in this city to patent an electrical smelter.

The big fair at Toronto, Ont., proved a bonanza to the electric street railway of the city. The total number of passengers carried during the fair was 1,879,298, exclusive of transfer passengers. The earnings exceeded those of last year, during the same period, by $15,167.

The Montreal Street Railway company is demolishing its car shed and the salt and sand house at Hochelaga section, in order to erect on the site a new car shed, with accommodation for 124 cars. The work will be completed in January, and the improvement will cost $40,000.

Complaints have been made to the Agricultural Department of Canada by Montreal shippers respecting damage occasioned to perishable articles of export, owing to lack of proper ventilation on some of the steamships. It is understood that at least 15 of the principal ocean-going steamers, sailing out of that port, will be fitted, this fall, with electric apparatus for proper ventilation.

A judgment has been delivered by Judge Loranger, at Montreal, which declares that the rolling stock of the Montreal street railway, the rails, wires and poles, are subject to assessment for municipal purposes. Hitherto they have not been taxed. The recent decision of the Ontario courts declaring the right of the city of Toronto to assess such rails, wires and poles, has had the effect of stirring up an agitation in Montreal, resulting in the judgment referred to.

The Royal Electric company of Montreal will hold a special meeting on the 18th of October next, for the purpose of authorizing an issue of preferred stock and the acquisition of shares in the Chambly Manufacturing company for an additional amount of $100,000. The Royal company has heretofore been paying 4½ per cent. on its mortgage bonds and a higher rate of interest for its customers' paper. The company's credit being excellent, any money required can be obtained in England at a much lower rate of interest, and the board deems it in the interest of the shareholders to avail themselves of that credit instead of issuing common stock at once for all the money needed, which stock would carry eight per cent. dividend.

The City Council of Toronto, Ont., has accepted the tender of the Sprague Elevator company of New York for the supply of three electric elevators, with generating plant for five, for the new municipal buildings of Toronto. The architect states that the electric plant will operate 300 or 400 lights in addition to the power required for running the elevators.

A company of capitalists in Winnipeg, Manitoba, purposes utilizing a portion of the water power on the Winnipeg River. The scheme involves the establishment of an electric railway from the mouth of the Whitemouth River to points along the Winnipeg River, and also the transmission of electric power to the city of Winnipeg.

The mayor of the town of Barrie has sent to the clerk of the Ontario Legislature notification of a recent by-law authorizing the Town Council to expend $35,000 on a municipal electric-lighting plant.

Mr. George Johnson, the Dominion statistician, has been looking into the railway statistics of Canada. He has reported that, for the year ended December 31, 1897, there were 35 electric railways in the different cities of the Dominion, having a total of 583 miles of track. They ran about 26,500,000 miles and carried fully 84,000,000 people during the year. For the year previous the figures were 10,000,000 less, while the steam railways carried only 16,000,000.

An interesting experiment in electrical lighting is being tried in the Parliament buildings here which, if successful, will lead to a beneficial change in the present method of lighting the Commons chamber. For some years past it has been lighted by installations of incandescent lamps, arranged in large chandeliers, suspended from the ceiling, giving a light which, while of sufficient brightness, was rather garish in effect. The experiment is now being tried of illuminating the chamber by an installation of electric lights set in a space between the roof and the ceiling, the latter consisting of heavy glass panels.

The twentieth-century movement has reached Toronto, Ont., in the form of a coach-delivery wagon, to be used by the Robert Simpson company of that city. The propelling power of this vehicle consists of two two-horse power motors, one geared directly to either hind wheel. This is the first electric delivery wagon in the Dominion of Canada. W.

PERSONAL.

Mr. Norman Taylor Harrington was recently married to Miss Anna Spencer, daughter of Robert C. Spencer of Milwaukee. Mr. Harrington is the young mechanical and electrical engineer of Chicago whose nonchalant bravery at Barcelona, just before the war, when the American consulate was threatened by an angry mob, won the admiration of the whole country.

Mr. Joseph Appleton, the chief engineer of the Electric Storage Battery company, is in the West, inspecting recent installations in Chicago and St. Louis.

Mr. Robert C. Morris of New Orleans, who possesses a franchise for electric lighting and power in that city and is organizing the New Orleans Electric Light and Power company, was in Chicago early in the week.

T. S. E. Dixon, a Chicago patent lawyer, and himself an inventor of no mean ability in the line of railroad appliances, was drowned in the surf on September 14th, while bathing at Virginia Beach, Va. Mr. Dixon left a widow and two children.

Mr. H. L. Parker, the president of the Emerson Electric Manufacturing company of St. Louis, a frequent Chicago visitor, was here last week, but not on business connected with the electrical trade, although he managed to see a number of his electrical friends.

John Lowber Welch, president of the Union Traction company, controlling the Philadelphia street railroads, has announced that he will retire from the directorate of that company. He will be succeeded as president by Vice-president and General Manager Parsons, late of Chicago. George W. Elkins, son of William L. Elkins, will succeed to the vacant directorship.

The trustees of Cornell University have enlarged the teaching staff of the College of Civil Engineering by the creation of a new professorship and the appointment of G. S. Williams, B. Sc., C. E., of Michigan University, class of 1889, as professor of civil engineering, in charge of the hydraulic laboratory. Mr. Williams has spent the nine years since his graduation from the engineering department of the University of Michigan in city waterworks construction, on the United States Lighthouse Board and as civil engineer to the Board of Water Commissioners of Detroit.

ELECTRIC LIGHTING.

A $10,000 electric-light plant is to be built at Williams, Ariz., without delay.

The Lincoln, Ill., gas plant was sold on September 15th to Joseph H. Vail of Chicago, representing eastern capitalists, for a consideration of $200,000. Frank M. Mills, the former owner, also owns a controlling interest in the waterworks and the Lincoln Electric Light company.

The Seabright (N. J.) Electric Light company's power house caught fire on the evening of September 14th and was totally destroyed. The town was consequently in darkness. The building was erected last spring at a cost of $12,000 and was insured for $8,000. The light supply to the hotels and seaside cottages was shut off.

ELECTRIC RAILWAYS.

The Terminal Railway company proposes to build an electric railway, as an extension, from South Pasadena to Alhambra, Cal.

The conversion of the steam dummy line south of Golden Gate Park into an electric road has proved so successful that the directors of the Market Street Railway company of San Francisco are considering the advisability of similarly converting the steam railway now running from California street and Central avenue to the Cliff. It is stated that the new electric line south of the park has proved a success beyond the anticipations of the directors. The old dummy line was for years operated at a loss. The new line has not only paid the cost of operation, but has paid interest on the cost of construction as well.

Promoters are busy agitating the project of a trolley line to connect Syracuse and Corning, the plan involving the consolidation of six traction companies, the Corning City line, the Penn Yan suburban road, the Geneva, Waterloo, Seneca Falls and Cayuga Lake traction line, the Auburn city line and the lines in Syracuse. In order to make an unbroken line of 132 miles it will only be necessary to build roads connecting Corning and Penn Yan, Cayuga Lake Park and Moravia or Auburn and Auburn and Skaneateles, if other lines already projected are carried out according to present plans. Power houses are located at Corning, Penn Yan, Waterloo, Cayuga Lake Park, Moravia or Cayuga, Auburn and Syracuse, which, it is said, would be sufficient to supply power for the proposed line.

MISCELLANEOUS.

Los Angeles, Cal., is considering the creation of the office of city electrician and the employment of an electrical inspector.

This is a recent lightning story: During a thunder-shower the other day the water supply at the home of Gilbert A. Ives of Sandisfield, Mass., was shut off by lightning. The water was conducted to the house and barn by a lead pipe from a spring 60 rods away. A large tree standing near the pipe

was struck and splintered, and then the lightning, entering the ground, followed the pipe to the spring, blowing off the boards and stones covering it to a distance of 50 feet. At the same time a ball of fire entered the house, shocking slightly one of the inmates, but doing no further damage.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until September 27th for furnishing the New York navy yard with a quantity of electric supplies, including electric-light fixtures as per specifications of 1897; 2,000 feet of galvanized steel cable; wiring appliances as per specifications of 1897; gaskets for junction boxes, switches, switch receptacles, etc.; 238 one and five candle power instrument lamps; between 15,000 and 20,000 fuses of various descriptions; 2,100 feet of hard-rubber tubing for lining tubes and brushes, 539 push-buttons and 60,000 feet of wire. Intending bidders desiring full specifications and blank forms of proposals can obtain them upon application to the Navy Pay Office at New York or to the bureau at Washington, D. C.

TRADE NEWS.

The Sitax Battery company of San Francisco has been incorporated with a capital stock of $10,000, to manufacture and sell wet and dry batteries. The directors are H. P. Thayer, E. H. Baxter and A. White.

The International Correspondence Schools of Scranton, Pa., have arranged a course of study in telephony. The work is in charge of Mr. Kempster B. Miller, formerly of Chicago, which is equivalent to saying that it will be executed with intelligence, fidelity and skill. A prospectus of the course has been issued by the Correspondence Schools and should be applied for by all interested in the study of the art of telephony.

To those interested in the painting of metal surfaces the little pocket-sized book issued by Edward Smith & Co. of 45 Broadway, New York, should be valuable. It is entitled "Painting to Prevent Corrosion, with Specifications," and was written by A. H. Sabin, a well-known engineer. The use of the durable metal coating made by the firm publishing the book is advocated, but the volume is more than an advertisement for Smith & Co., covering, as it does, the whole subject of the painting of metal structures. The book is handsomely printed, liberally illustrated and bound in leather.

The electrical trade will be interested to learn of the recent arrangements made by the Western Electric company to exclusively represent the Stanley Electric Manufacturing company in Michigan, Ohio, Kentucky, Tennessee, Alabama, Mississippi, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Arkansas, Louisiana, Texas, Indian Territory, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Montana, Wyoming, Colorado and New Mexico. A complete stock of transformers and other appliances, to insure prompt shipment, will be carried in Chicago. Correspondence is solicited from intending purchasers of alternating-current apparatus for any purpose—single-phase, polyphase, power transmission, transformers, switchboards, instruments, etc.—and all orders and inquiries will have immediate attention.

William Roche, inventor and manufacturer of the New Standard dry batteries, is running his two large floors at 259 Greenwich street, New York, overtime to keep up with orders. He is getting some large orders for a small oval cell he is now making to supersede the acid pocket cell for electric scarf pins. He has a miniature lamp that lights up brightly with one of these cells, which is surprising, considering that the cell is only 1⅝ by 1¼ by 3½ inches over all. Mr. Roche's 7 by 3-inch cell is being adopted for railroad signals and coin-operated machines throughout the country, and the manufacturer says that there is really no more economical cell of any kind for cautery work, gas-engine ignition, etc. If a rush of business counts for anything the users of batteries must be getting "on" to the New Standard now. The Standard Telephone and Electric company, Madison, Wis., sells the battery in the West.

BUSINESS.

Tobin bronze is used for commutator bars, among other purposes. It is made by the Ansonia Brass and Copper company of New York, which claims many fine qualities for the metal. A pamphlet telling about its merits is sent on application.

The Berlin Iron Bridge company, East Berlin, Conn., has the contract for furnishing the steel work for the memorial hall which is building at Westerly, R. I. This building is to be fireproof throughout, has steel floor beams and columns supporting the floor structure and steel trusses and beams for the roof.

The John S. Nowotny company, 313 East Third street, Cincinnati, O., has secured the agency for the Crains Parhelion arc lamp for southern Ohio, Indiana and Kentucky. Mr. Nowotny is a pioneer in the enclosed arc-lamp field and pins his reputation and energy upon the superiority of the Parhelion lamp.

The American Pegamoid company of 346 Broadway, New York, is proud of its aluminum paint, and justly so, if one may judge from the testimonials received. The company makes other paints and lacquers and tells about them in a neat pamphlet, recently issued. The "bright metal protector" is especially interesting to engineers and dynamo tenders.

The Leschen-Macomber-Whyte company, 19 South Canal street, Chicago, has just placed on the market a new specialty in the form of an extra flexible arc-lamp cordage. This cordage is particularly adapted to the arduous service involved in the constant raising and lowering of arc lamps for outside and street-lighting service. The fact that the cordage has to stand all sorts of weather and yet be perfectly reliable in the matter of sustaining so delicate a piece of apparatus as an arc lamp makes it important that the buyer of cordage should take no chances. The Leschen-Macomber-Whyte company feels that a test of hard service will be all that is necessary to demonstrate to a user that this new cord is a "winner."

The recent fluctuations in the prices on sockets, receptacles, cut-outs, insulators, etc., have made it somewhat difficult for the ordinary buyer to keep track of the market prices on these goods. The Electric Appliance company has just issued a special price-list of all of this material, giving trade prices that are strictly up-to-date. This list is in the form of a small circular, and should be of considerable value to the purchaser of staple electrical supplies.

Eugene Munsell & Co. of New York and Chicago, importers and wholesale dealers in mica, report a very gratifying demand for their India mica. They carry a large stock at both their warehouses in New York and Chicago, and are, therefore, in a position to execute orders promptly. This concern was one of the pioneers in the preparation of mica for electrical purposes, having sold to the Edison company at a time when the latter required but two armature winders, dating back in the '80's.

Nearly everyone engaged in the electric lighting and street-railway business knows of the Swarts Metal Refining company, Chicago, and its popular president, Seymour Swarts. As is well known, this company is always in the market for old copper wire of any description, for which it pays the highest market price. The company is constantly increasing its business, and at the present time has on its books almost every prominent electric-lighting and electric street-railway company.

Engineers complain that on account of the inferior quality of gaskets they experience a great deal of trouble with leaking man-hole and hand-hole plates, and it is not an uncommon thing with engineers who use cheap, inferior gaskets to have them blow out entirely, which, in most cases, necessitates the shutting down of the plant and frequently results in personal injury. The Garlock cut gasket for man-hole and hand-hole is claimed to be superior to all others and is guaranteed to give satisfaction. It is manufactured by the Garlock Packing company, Palmyra, N. Y.

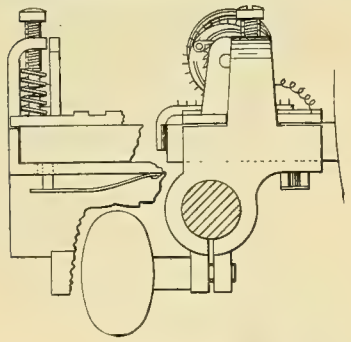
K. McLennan & Co. of 100 Washington street, Chicago, sole manufacturers of Gale's commutator compound, answering a repeated question, state that their commutator compound can be used on collector rings with as good results as on commutators. Wherever there is trouble from sparking of brushes, they add, Gale's commutator compound will overcome the difficulty. The manager of the firm stated recently that the increased demand for "Gale's" had necessitated the increase of the laboratory, and the firm now has facilities to fill all orders without delay. In the last two months the orders have come so rapidly that there has been a delay of a day or so in filling them, but this will no longer occur. It is now claimed by the firm that nearly every user of a generator or motor uses the compound; and those, if any, that have not tried it can receive a sample free upon request to their supply houses or to the manufacturers.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 13, 1898.

610,524. Electrically Controlled Valve for Hydraulic Presses. William B. Cleveland, Cleveland, Ohio. Application filed January 21, 1898.

The valve controlling the liquid under the plunger of a hydraulic press is connected to an electromagnet having a source of electricity for its coil and having the contact terminals of the coil respectively upon the stationary and moving element of the press.



NO. 610,620.

610,539. Electric Clock. Frank Hope-Jones and George B. Bowell, London, England. Application filed December 18, 1897.

The first claim is: The combination of an electrically wound regulator, a secondary clock, the hands of which are moved through the agency of an electric current, means in the regulator for making the electric circuit which operates the secondary clock, and means in the secondary clock for opening said circuit.

610,620. Commutator Brush Holder. William K. Bassford, Jr., Bound Brook, N. J. Application filed February 1, 1898.

A brush holder consisting of a base plate having a channel for containing the brush, a pressure plate upon the brush to hold it in the channel, a pusher bearing upon the end of the brush, and a motive device carried by the pressure plate for driving the pusher.

610,626. Composition Containing Casein for Electric Insulating or Other Purposes. Peter H. Hansen, Copenhagen, Denmark. Application filed February 7, 1898.

A composition consisting mainly of casein, india rubber and asphalt.

610,704. Telephone System. William W. Dean, St. Louis, Mo. Application filed September 3, 1897.

The combination with a spring switch for controlling the association of a telephone with a telephone line, of an actuating device, having separable engagement with the spring switch and which, when operated in one direction, serves to actuate the spring switch to open the telephone circuit, and means independent of the actuating device for directly engaging and maintaining the spring switch in the position in which it has been placed by the actuating device, and an electromagnet for operating this means, whereby the circuit through the telephone may be maintained open and the actuating device, by reason of its separable engagement with the spring switch, may be changed as to position independently of the electromagnet and spring switch.

610,705. Brush for Electrical Machines. Joseph W. Dickey, New York, N. Y. Application filed December 8, 1894.

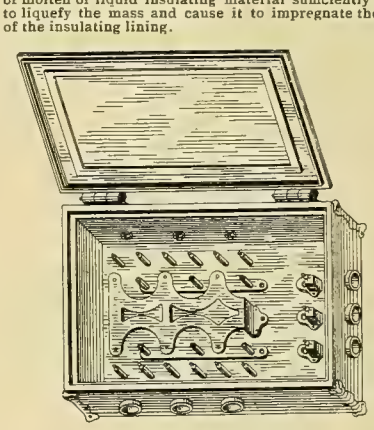
A woven-wire brush is described.

610,712. Apparatus for Starting and Controlling Electric Motors. Theodore W. Kloman, New York, N. Y. Application filed April 4, 1898.

The field coil or coils of the motor are connected permanently in circuit with a main source of current supply; there is also an independent source of current supply and switching mechanism for varying the current flow therefrom through the armature of the motor in accordance with the demands put upon it, with additional circuit connections whereby the independent source of current supply may be disconnected from the armature and the main source of current supply substituted therefor, the arrangement being such that the independent source of current supply is never electrically connected with the main source of current supply.

610,726. Art of Bending Armored Conduit Tubes. William T. Ruete, New York, N. Y. Application filed November 24, 1897.

This method of forming a curved armored conduit tube having a flexible porous lining consists in first filling the tube with a mass of liquefiable insulating material and allowing it to solidify, then subjecting the tube to a pressure sufficient to bend it to the desired degree of curvature, and finally subjecting the entire structure to a bath of molten or liquid insulating material sufficiently heated to liquefy the mass and cause it to impregnate the pores of the insulating lining.



NO. 29,344.

610,767. Magnetic Separator. Ambrose Monell, Munhall, Pa. Application filed January 10, 1898.

This curious device is mounted on a wheelbarrow. A drum is secured between and concentric with the wheels of the barrow; a series of electromagnets is mounted upon the drum, and a commutator is arranged to successively supply the current to and cut it off from the magnets.

DESIGN.

29,344. Fuse Box. William F. Bossert, Utica, N. Y. Application filed July 21, 1897. Term of patent, seven years.

The design for a fuse box shown herewith.

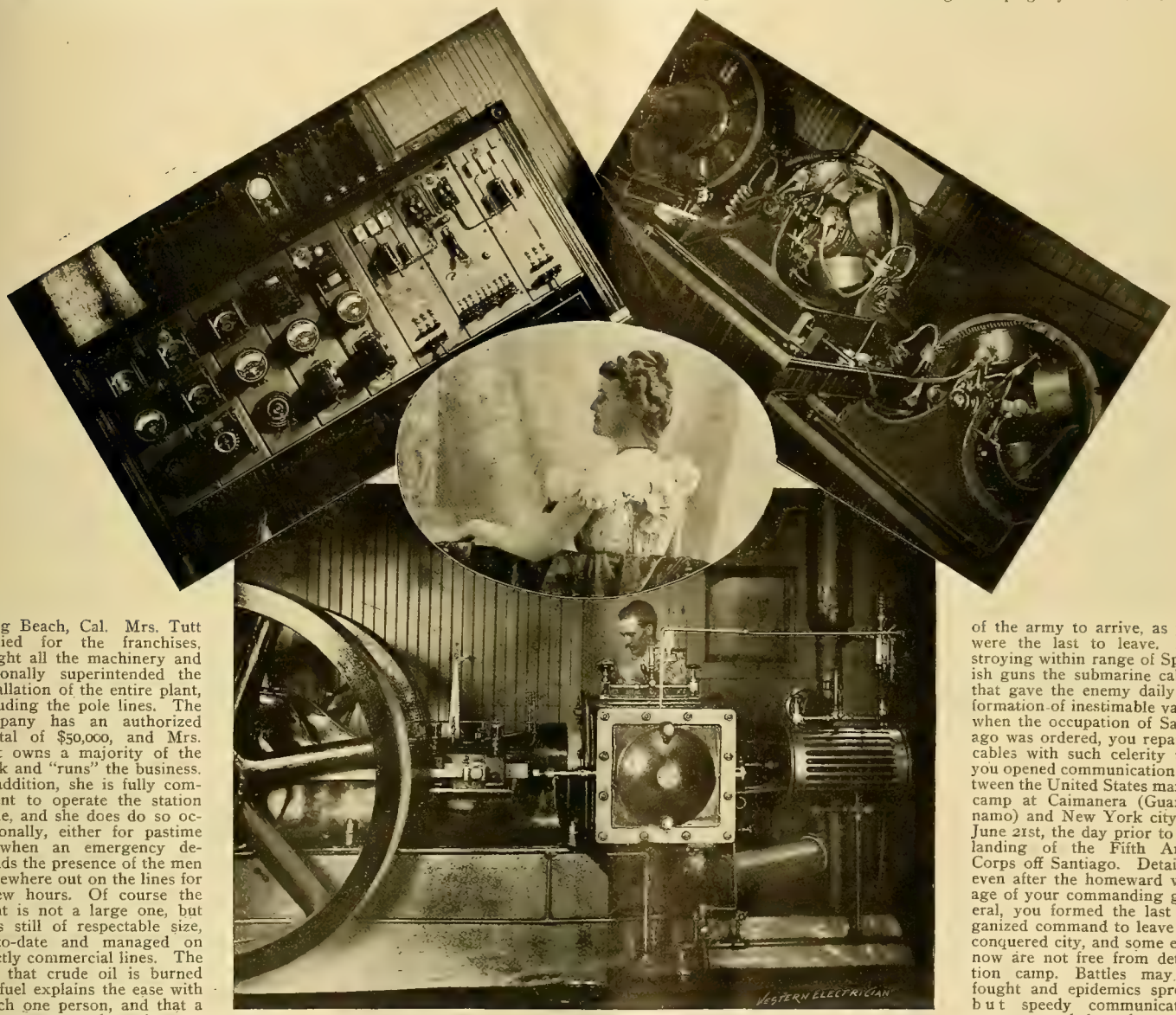
Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, OCTOBER 1, 1898. No. 14

The Long Beach Electrical Company and Its Manager.

At least one electric-light plant in the country is managed and controlled by a woman. Perhaps there are others of this description, but there are not so many of them that the attraction of novelty has been dissipated. The equipment which forms the subject of the accompanying group of illustrations and this brief description was purchased and installed by Mrs. Iva E. Tutt, who is now in active management of the property. It belongs to the Long Beach and San Pedro Electrical company of Long Beach, Cal. Mrs. Tutt applied for the franchises, bought all the machinery and personally superintended the installation of the entire plant, including the pole lines. The company has an authorized capital of $50,000, and Mrs. Tutt owns a majority of the stock and "runs" the business. In addition, she is fully competent to operate the station alone, and she does do so occasionally, either for pastime or when an emergency demands the presence of the men somewhere out on the lines for a few hours. Of course the plant is not a large one, but it is still of respectable size, up-to-date and managed on strictly commercial lines. The fact that crude oil is burned for fuel explains the ease with which one person, and that a woman, can run the entire generating plant. The adjustment of a few valves keeps the furnace fires perfectly regulated.



Switchboard. Mrs. Iva E. Tutt, Manager. Engine Room. Dynamos.

THE LONG BEACH ELECTRICAL COMPANY AND ITS MANAGER.

The present equipment consists of a Stirling water-tube boiler, fitted for mechanical draft, a Ball tandem-compound engine and General Electric dynamos for direct and alternating current. The direct-current distribution is by the Edison three-wire system. The switchboard is well equipped with instruments and protective devices, and the whole plant is well arranged and carefully kept. The electrical department is in charge of Mr. C. C. Glass, formerly with the Pasadena Light and Power company. The directors of the company are E. S. Tutt, president; C. C. Glass, vice-president; I. E. Tutt, secretary, treasurer and manager; E. J. Thomas and W. M. Glass.

Mrs. Tutt applied for and obtained a franchise granting her the right to erect, operate and maintain an electric plant to supply light, heat and power in Long Beach in the spring of 1895, and she immediately began negotiations for the purchase of property and the necessary machinery and electrical equipment. On July 25, 1895, the plant was in successful operation; and the service has been continuous to the present time. In the fall of the same year the energetic manager applied for and obtained a similar franchise in San Pedro, and on April 7, 1896, the transmission line connecting the two cities by way of Terminal Island and by a submarine cable under the inner harbor at San Pedro, being completed, the two cities were connected, and successfully lighted from the same central station. Terminal Island has since been added. The company was incorporated in 1896. The present prospect for business is excellent, and this is largely due to the fact that the erection of the government breakwater at San Pedro is about to be begun. The company expects to enlarge its plant by the addition of a new boiler, a 250 horse power engine and a 150-kilowatt three-phase alternator, with the necessary station apparatus and line construction.

Mrs. Tutt sees nothing unusual in her work and keeps busily engaged in planning new business, making contracts, purchasing supplies, paying bills and managing the affairs of the company generally. She is a member of the organization known as the "Daughters of the American Revolution" and is a descendant of Edward Winslow, the first governor of the Colony of Plymouth, as well as of the Cutlers, who came to Massachusetts in 1634, and are best known through Manasseh Cutler, the founder of Marietta, Ohio.

Gallantry of Signal Service Men.

In an order issued from the War Department General A. W. Greely, chief signal officer of the army, highly commends the members of the Signal Corps for their work in the Santiago and Porto Rico campaigns. In regard to the Santiago campaign General Greely says:

"In the Santiago campaign you were the first of the army to arrive, as you were the last to leave. Destroying within range of Spanish guns the submarine cables that gave the enemy daily information of inestimable value, when the occupation of Santiago was ordered, you repaired cables with such celerity that you opened communication between the United States marine camp at Caimanera (Guantanamo) and New York city on June 21st, the day prior to the landing of the Fifth Army Corps off Santiago. Detained even after the homeward voyage of your commanding general, you formed the last organized command to leave the conquered city, and some even now are not free from detention camp. Battles may be fought and epidemics spread, but speedy communication must nevertheless be maintained, and, owing to your efforts, the American army in Cuba has not been isolated telegraphically a single day.

"In the Cuban campaign you arranged, maintained, and operated a system of cable and land lines—partly commercial, partly war cables, partly flying telegraph lines and partly telephone lines—that enabled messages to pass in 20 minutes from the executive mansion in Washington to the headquarters of the army before Santiago, and which offered direct and immediate communication between the secretary of war in his office and the Signal Corps men in the advanced rifle pit on the right, the left and in the center of our intrenched army within 400 yards of the enemy. When the city fell your lines followed immediately army headquarters as moved therein.

"No one will ever know the difficulties—physical and moral, climatic and service—under which you labored in Cuba. Heat and thirst, hunger and fa-

tigue—these present sufferings with impending disease and death you endured and faced uncomplainingly with the rest of the army, but these conditions never prevented the prompt, cheerful and efficient discharge of the important duties devolving unremittingly day and night on the Signal Corps.

"Although not counted a part of the fighting force of the army, you unhesitatingly advanced, in obedience to orders and under the direction of an officer of another corps, the Signal Corps balloon to the skirmish line, where you sent up and occupied it under sharp fire of shrapnel and heavy fire of musketry, until, rent and perforated, it fell useless to the ground. Later, your balloon destroyed, you carried to the front, under heavy fire, rapid-fire guns for the use of the First Volunteer Cavalry."

The order concludes with this statement:

"The Signal Corps has filled neither the guardhouse nor the hospital. Serving in the field in Cuba, in the Philippines and in Porto Rico, and in home garrisons at Tampa, Chickamauga, Camp Alger, Jacksonville and Montauk, yet your total aggregate of over 1,300 has lost by disease in camp and field to date only five officers and men included."

A letter from Manila tells of the brave conduct of E. E. Kelly of the Signal Corps during the engagement before the Philippine capital. In the heat of the conflict he carried a wire a mile and a half into the Spanish entrenchments, while the bullets flew all around him. Two comrades fell at his side, one fatally wounded. For his bravery he was made a first sergeant. General Merritt has sent his name to President McKinley for recognition for "gallant and meritorious conduct during the capture of Manila," and it is expected that he will at least get a congressional medal.

Mr. Kelly is a telegraph operator, well known in Chicago. He worked here for the Western Union company and afterward went to the Associated Press. For a time he was employed in the Tribune telegraph room. Kelly is a large man, weighing fully 250 pounds. It was thought his size would preclude his enlistment. He studied law in Chicago and went to South Dakota to practice. There he enlisted in an infantry regiment and was sent to San Francisco, where he was transferred to the Signal Corps because he was a telegraph operator.

Electrical Transportation of Troops.

No regiment of regulars won greater fame and honors in the recent war with Spain than did the Fighting Thirteenth. When the war broke out the various companies of this command were quartered at Fort Columbus, Governor's Island, Fort Porter, Buffalo, and at Fort Niagara, Youngstown, at the mouth of the Niagara River. Orders came for them to move, and on April 19th they started for the front. They were taken to the South, where they went into camp, embarking for Cuba from Tampa, Fla., on June 14th. Colonel Smith of the regiment did not go to Cuba with them, but was ordered before a retiring board for examination. After the regiment had won its laurels he was allowed to join it.

On June 22d the regiment landed at Daiquiri, and on July 1st took a prominent part in the charge of San Juan Hill, the regiment being led by Major Auman. The Thirteenth was present before the city of Santiago and took part in the siege. The strength of the regiment when it went away was 520, and the number brought back was 346.

On the 8th of August the healthy survivors of the command embarked at Santiago for the United States, and six days later, on August 14th, they arrived at Montauk Point. There they remained in camp until September 14th, when they started for Forts Niagara, Porter and Columbus. The Buffalo contingent arrived in that city on the afternoon of September 15th, and was given a grand reception. The company destined for Fort Niagara reached Lewiston at 3 p. m. on the same afternoon, and was also honored both in Lewiston and Youngstown. From Lewiston to Youngstown the troops traveled over the Lewiston and Youngstown electric road. The illustration herewith presented shows them at Lewiston about to take the trolley cars for the fort. They rode in a special car, nicely decorated, and in personal charge of Superintendent Heller, who kindly looked after their comfort in every way.

ELECTRICAL TRANSPORTATION OF TROOPS.

The Electric Railway as an Auxiliary to Coast Defense.[1]

By W. J. Clark

The rapid history making of the past few months has caused the mention of certain problems, which a year ago would have seemed ridiculous, to be worthy now of the most serious consideration. While it is unwise to bring up for discussion here ordinary matters of state and national policy, it is conceded, I think, that no matter what differences of opinion exist among us on the question of national extension and aggrandizement, there is a unanimous feeling among all Americans that this is now a Nation begun with an exceedingly large "N," and that the true policy for its future is to strengthen it in every legitimate way, by displaying American intelligence, inventive ability and commercial shrewdness in such a manner as to make it the strongest of all earth's nations in peace, so to better preserve such relationship for all times to come.

Warlike as the title of this paper sounds, its true object is most peaceful, it being simply to advocate the adoption of a broader policy in the granting of electric-railway franchises, to the end of harmonizing their construction with other electrical lines as well as with the general steam-railway system of the country, all to the end of strengthening our country in peace, that she may be better prepared for war in the future, and thus avoid it.

That improved methods of transportation are equally essential to the commercial development of the country or to its defense against outside foes, if such country is well populated, is a fact which has been conceded for so long a time as modern civilization has existed. So originality cannot be claimed for the theories which are advanced herein, but the development of the electric railway and the weakness of our seacoast, in certain essentials to defense, so forcibly brought to our attention recently, makes it fitting to call attention here to the importance of the application of the theory in its broadest way to the future development of American electric railways. In this way the marvels which have been performed unconsciously in constituting an important auxiliary to our coast defenses may hereafter be made still more valuable by following some comprehensive plan dictated either by the national government or by the executive authority of the various states, working in close harmony to the attainment of a specific end, better adapted to ordinary commercial requirements than the present system of making the procurement of franchises dependent upon the whim of local townships and municipalities. The latter often disregard everything outside their own immediate surroundings, and restrict railway companies from making what would be a natural form of development, which, as recited, would be of the greatest importance to the nation in guarding its coasts, should it ever be necessary to do so again.

This application of the general theory is no more original with the writer than the theory itself, for certain of the continental powers of Europe have for several years been encouraging the construction of street railways for the avowed purpose of military expediency, going so far as to grant subsidies or extraordinary concessions where the construction of the line filled in some important link in transportation facilities. The great essential insisted upon has been that, in their construction, such railways should conform in gauge, special work and curvature with the general steam-railway system of the country, so that in emergencies the rolling stock of the latter could be operated over the lines of the former. This would be more especially in the case of besieged cities, to afford a means of ready transportation to all points within the line of fortifications, without breaking bulk, also to make it possible hastily to transport bodies of troops to any points within such district in the quickest possible manner.

While but little has been said concerning this policy in the public press, the work of this character which has been done about some of the European cities is astounding, and is viewed by the military authorities of such countries as being one of the most important steps ever taken in the line of defensive military operations. This being true, it requires no argument to demonstrate that a broader application of this plan to our extended seacoast would be of far greater importance than the application of it to Europe, where good roads exist almost everywhere, for, as is well known, much of our seacoast does not enjoy the possession of good wagon roads. On the other hand, the electric lines already reach nearer to very important points along the coast than do the steam lines, while, especially along the seashore of Massachusetts, the electric lines could deliver, if necessary, many more troops in the interior within a given time at such points than would be possible for the steam railways.

All over the United States information is readily obtainable concerning the street-railway systems, with their trackage, routes and rolling stock, as well as in their interconnections and the possibility of temporarily increasing the facilities of any particular road by combination with others. Such was not the condition, however, as regards electric railways when, a few months ago, we were all worrying for fear that landing parties from the then-supposed powerful Spanish navy might make it temporarily uncomfortable at certain exposed points along our Atlantic seaboard, beside destroying much valuable property. It was suggested, therefore, to the writer that he obtain maps of all the existing street-railway lines along the Atlantic and Gulf coasts, show their connections and intersections with the steam roads and other street-railway lines, and, so far as possible, suggest how much could be done, should military necessity require it, to cause such street-railway systems to become an important auxiliary to the steam lines for rapidly moving troops and supplies to any points required along the seacoast. This work involved examination of the possibilities of making connections with the steam lines, the utilizing of such track as would be possible from its type, and the form and character of special work, so that steam rolling stock could, if necessary, be operated over the street-railway lines, while the possibilities of using the current of one electric railway to help out congestion upon some other, and all such similar matters, were most carefully gone into. The work was most interesting, hurriedly though it had to be done, and, to the credit of every street-railway corporation along the coast, it should be said that each and all patriotically responded to requests with the fullest information that could be desired concerning their systems, and expensive maps were furnished freely without charge. In fact, the management of certain important systems were so enthusiastic that had the War Department requested it, it is probable that many miles of new track would have been built by them without waiting to question the possibilities of its future earning power or waiting for local franchise rights. Of course, it would not be proper for the writer now to give to the world the entire results of the investigation, but to attain a most important object, and to strengthen our electric-railway systems where they are weak, it should be said that stretching along the coast from Calais, Me., to Galveston, Texas, are 92 distinct street-railway systems, any one of which might have been an important factor in transportation for military purposes should Spain have made a demonstration against our coast. The aggregate length of these systems is about 6,897 miles, and the capacity of some of these for handling traffic to several coast points is simply astounding, it being frequently two or three times that of the steam railways which approach the same localities.

1. Read before the New York State Street Railway association, at Manhattan Beach, September 13, 1898.

Personal Exhibit of Bion J. Arnold at the Trans-Mississippi and International Exposition.

Occupying a prominent place in the Nebraska agricultural exhibit at the Omaha Exposition is a series of grain pictures which attract considerable attention. They are made up entirely of cereals, and represent the history of more than one Nebraska boy. The first picture shows the yoke of oxen and the "prairie schooner" as the young man starts out to find a home in the West. The second scene represents the first sod house, while the third is a view of a modern house surrounded by well-filled barns and cultivated fields, the result of thirty years of work. On the platform in front of the pictures, and worked out in an ingenious manner with grains and grasses, is a life-sized group representing the happy family of a prosperous Nebraska farmer gathered about a Thanksgiving dinner. The collection is an object lesson intended to show what perseverance and hard work will accomplish, and is calculated to inspire the ambition of the youth of Nebraska.

Of equal interest and fully as inspiring to the western boy is another exhibit, in the Electricity Building, which also shows what it is possible for a Nebraska boy to accomplish by concentration of purpose and diligent effort. This is the personal exhibit of Bion J. Arnold, consulting electrical engineer of Chicago. Mr. Arnold spent his boyhood days in Ashland, Nebraska, and obtained part of his education in the State University at Lincoln. It is especially appropriate and fortunate, therefore, that an exhibit should have been secured from him showing the results of his 20 years of effort in engineering work. The exhibit is located in the southeastern corner of the building and will repay a careful inspection.

Fig. 1 shows a view of the space. On the right is a table upon which has been placed the result of a number of Mr. Arnold's boyish efforts. Here is shown a small combined steam boiler and engine (Fig. 2) which he constructed at the age of 15, after having made a number of smaller engines. The engine is crudely made, and it shows plainly some of the difficulties under which it was built, and indicates clearly that Mr. Arnold must have developed his inclination to "make things" at an early day. The bottom of the boiler is part of a wagon-wheel hub; the fly-wheel is an old hand wheel of a steam valve, while the steam pipe and throttle valve were evidently borrowed from a dismantled gas fixture. The fact that the little engine worked must have served as an inspiration for further effort, for there is exhibited an old-fashioned high-wheel bicycle which was made by Mr. Arnold the next year. This wheel is said to be the first bicycle made in Nebraska, and it is interesting to know that it was made by Mr. Arnold long before he had ever seen a bicycle or velocipede of any kind. One can imagine something of the interest this wheel must have created in the pioneer days.

At the age of 18 Mr. Arnold built a working model of a locomotive. This little engine, shown at the left in Fig. 1, is really a wonderful piece of mechanism. It is almost an exact duplicate in every part, on a scale of three-quarters of an inch to the foot, of engine No. 31 of the Burlington road, which in 1879 ran through the town of Ashland. It is 36 inches long by nine inches high, and weighs about 30 pounds. It can be fired up and runs perfectly by steam in either direction. On the side of the cab is the name of the little locomotive, "Nebraska." It is complete in every respect. Below the case which contains it is shown a photograph of the old blacksmith shop in which it was built, and also an affidavit from the smith himself setting forth that the little locomotive was built entirely by Mr. Arnold, who, without assistance, made his own patterns, cast all the parts, and with a few crude tools put the mechanism together. A number of newspaper clippings from Ashland, Lincoln and Omaha papers show that young Arnold's locomotive created a furore at the time it was completed.

With such a promising start the visitor is prepared to find in Mr. Arnold's exhibit the record of enterprises of considerable importance. Starting with the first efforts, the whole exhibit has been arranged to show in chronological order the engineering problems upon which Mr. Arnold has been engaged.

The years between 1879 and 1886 were evidently a period of preparation, for nothing is shown as the direct result of these years of work. Dated 1886, however, is the assembly drawing of a 1,500 horse power vertical compound engine, which was designed by Mr. Arnold for the Iowa Iron Works of Dubuque, Iowa. A fine drawing of a large railway locomotive, dated 1888, shows the alterations made upon these engines by Mr. Arnold while mechanical engineer for the Chicago Great Western railway. It will add interest to the exhibit to note that Mr. Arnold has recently been appointed consulting electrical engineer for this same railroad, after having been out of its service for nearly ten years.

In 1890 Mr. Arnold branched out into electric-power-station engineering. A large framed drawing in the upper left-hand corner shows the well-known Little Rock (Ark.) street-railway power plant. When this station was completed it was considered a model of its kind, but the large amount of space taken by the belted generating machinery looks strange in this day of direct-connected units. Photographs and drawings of the power plants of the St. Joe and Benton Harbor railway, and of the North Shore electric railroad, Chicago, shows something further of the results of Mr. Arnold's work in these lines in the two following years.

In 1893 Mr. Arnold was appointed consulting electrical engineer for the Intramural railroad at the World's Columbian Exposition, and had charge of the design and construction of the power plant for that road. A panel of photographs shows exterior and interior views of this plant, which, it will be remembered, was considered, on account of its large direct-connected units, a marked step in advance at the time of the World's Fair.

Labeled 1894 are photographs of the power station of the Ft. Dodge (Iowa) Light and Power company. This is a monocyclic plant, and was the first station built on Mr. Arnold's system of power-station construction. Interesting adaptations of this same system are shown in the drawings and photographs of the electric-power plants of the Chicago Board of Trade, the Englewood and Chicago Electric Street Railway company, the Land, Title and Trust building, Philadelphia, and the University of Michigan, Ann Arbor. Recent addition to the exhibit show the "Arnold system" as adapted to the plants of the W. B. Conkey company, Hammond, Ind.; the Chicago and Milwaukee electric railway and the Garrett building, Chicago.

Several blue-prints show cross-sections and elevations of the central power station for the Imperial Electric Light, Heat and Power company of St Louis, Mo. The contract for this entire installation is held by a company of which Mr. Arnold is president and engineer. The plant is now in process of construction. Its generating machinery will be connected on the Arnold system, and the different combinations between engines and dynamos will be secured by means of magnetic clutches. This plant was recently described before the American Institute of Electrical Engineers and is said to contain a number of departures from ordinary practice.

FIG. 1. PERSONAL EXHIBIT OF BION J. ARNOLD AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—GENERAL VIEW.

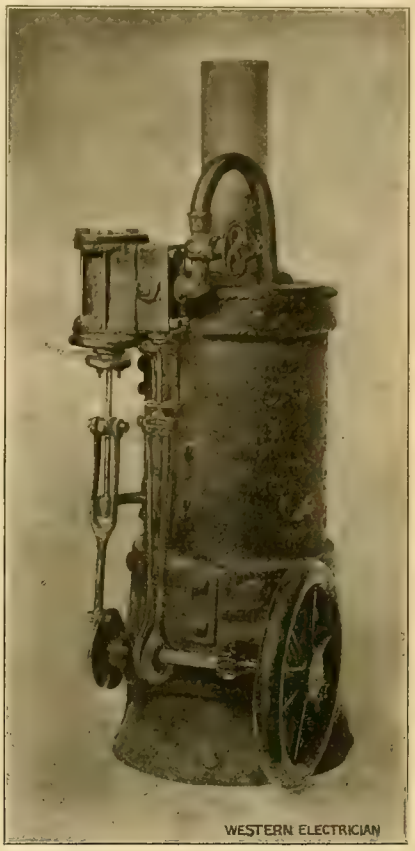


FIG. 2. PERSONAL EXHIBIT OF BION J ARNOLD AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION—STEAM BOILER AND ENGINE.

There is but little in the exhibit to represent Mr. Arnold's work in the storage-battery field. The accumulator in the Chicago Board of Trade plant shows that he early advocated the use of the storage battery in connection with power plants, while the adoption of a battery auxiliary in connection with the Imperial plant and many other large power plants indicates that the use of accumulators in central stations has become accepted practice—a development which must be a source of satisfaction to one who has advocated their use against much opposition.

The drawing of the power plant of the Chicago and Milwaukee electric railroad indicates the solution which has been worked out by Mr. Arnold of the problem of electric service for high-speed and long-distance suburban roads. This station contains both direct-current and alternating-current machinery, the extreme sections of the road being operated by means of induction motors operating rotary converters in sub-stations, as described in the Western Electrician of August 20th.

The entire exhibit is neatly displayed, and its educational value cannot be overestimated. The successive steps which Mr. Arnold has taken from his first boyhood efforts to his present position in his profession are clearly shown, and he is certainly to be congratulated on the success which he has earned while still a young man.

Westinghouse-Walker Combination.

George Westinghouse, the president of the Westinghouse Electric and Manufacturing company, is credited with the following statement of the facts of the absorption of the Walker company, speaking in New York on September 21st:

"The election this day of Roswell P. Flower and Anthony N. Brady as members of the board of directors of the Westinghouse Electric and Manufacturing company, to represent the interests of the former stockholders of the Walker company, completes the union of the interests of the Walker com-

pany of Cleveland with those of the Westinghouse Electric and Manufacturing company. The purchase by the Westinghouse company includes substantially all of the outstanding stock, and all but $850,000 of the $2,500,000 of the 20-year bonds of the Walker company, the $850,000 remaining a first lien upon the property. The recent sale by the Westinghouse company of $3,000,000 debenture certificates has been erroneously connected with this transaction. The entire proceeds of the sale of these debenture certificates were used in retiring the floating and other debt of the company, as previously announced."

A recent Schenectady dispatch says that an officer of the General Electric company, who has the authority to speak, made this statement:

"The only relation that the General Electric company sustains to the reported Walker-Westinghouse arrangement is that, if the purchase has been made by the Westinghouse company, the General Electric company has the full right, by reason of its previous agreement with the Westinghouse company, to use all the patents and devices of the Walker company."

Power Plant of the Valley of Gresivaudan.

The arrondissement of Grenoble in the French Alps is wholly mountainous, its deep valleys are fertile, while the hoary peaks which separate them know but two seasons—summer and winter. There are localities where there is snow for eight months in the year, and there are sheltered nooks where snow is never found. One of the most picturesque and productive of these valleys is that of Grésivaudan, through which the river Isére courses its way to its confluence with the Drac, a distance of 48 kilometers. Scattered along this valley are many villages and hamlets with a multiplicity of manufactories of paper, carborundum, cloths, articles of electro-metallurgy, telephones and acetylene, at present absorbing only a part of the 129,400 horse power, which it is estimated can be made available through electricity. This thriving valley has been described by E. Vigneron, in l'Energie Electrique, as the home of both "black and white coal," or anthracite and falling water, each of which has its own industrial following. M. Berges, an artisan of Lancey, has associated with himself M. Labour, director of one of the Parisian electrical companies, and they have set about the organization of a system of electrical distribution, at a potential of 12,000 volts, over a distance of 40 kilometers, with its central station at Lancey, on the west side of the valley. It may be mentioned that M. Berges was the first to utilize the watercourses of the Alps by damming the mountain torrents and forming artificial lakes from which to draw his power.

The line is aerial and the current alternating.

The chute utilized for the power at Lancey is 450 meters in height, with a discharge of 75 liters, which gives as a result 260 horse power at a speed of 400 revolutions per minute. The turbine is directly coupled to the generator, as shown in Fig. 1. The transformers are filled with oil and have their cutsides connected to ground. They reduce the current to 120 volts at the point of consumption.

The line runs both north and south of the central station, and at about midway of the valley's length crosses to the east side, and again runs up and down from that point. The builders of the system, like their brother workmen in the United States, had many difficulties to overcome aside from those of physical geography. In placing a thousand poles they were not infrequently called to halt. In one little hamlet the gang of 40 pole setters, after an engagement with the mayor and gendarmes, was arrested and had to pay 60 cents damages.

The station at Lancey is but the commencement of the plan to be carried out of furnishing all the power required for every factory in the valley. In each village a general transformer is placed in

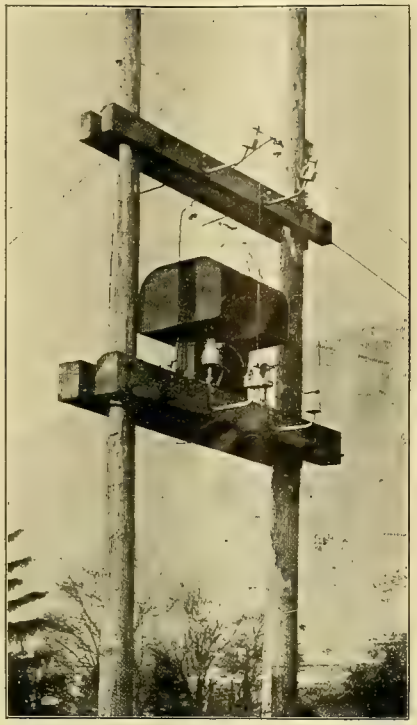


FIG. 2 POWER PLANT OF THE VALLEY OF GRÉSIVAUDAN. —TRANSFORMER AT LA CROIX-MONTFLEURI

a very substantial, if not especially handsome manner, as shown in Fig. 2. The coils of these are immersed in paraffine, and are protected by two fuses in both primary and secondary conductors and an automatic ground and a lightning arrester.

The following-named prices are charged for incandescent lamps: For one lamp, 25 francs per annum, two lamps 35 francs, three lamps 60 francs, four lamps, 65 francs and for each additional lamp five francs. An agent in each village supplies lamps in exchange for old ones, and communicates by telephone with the power house.

A proclamation of four articles, everywhere posted, informs the patrons that "the dynamo will be set in motion at 5 p. m.—never before; that the dynamo will be shut down at 7 a. m.—never later; that the dynamo will not be set in motion except in the presence of M. Pariot or of M. Rossignol, and lastly, that a violation of these rules may result in causing a human death and in unpleasant after consequences."

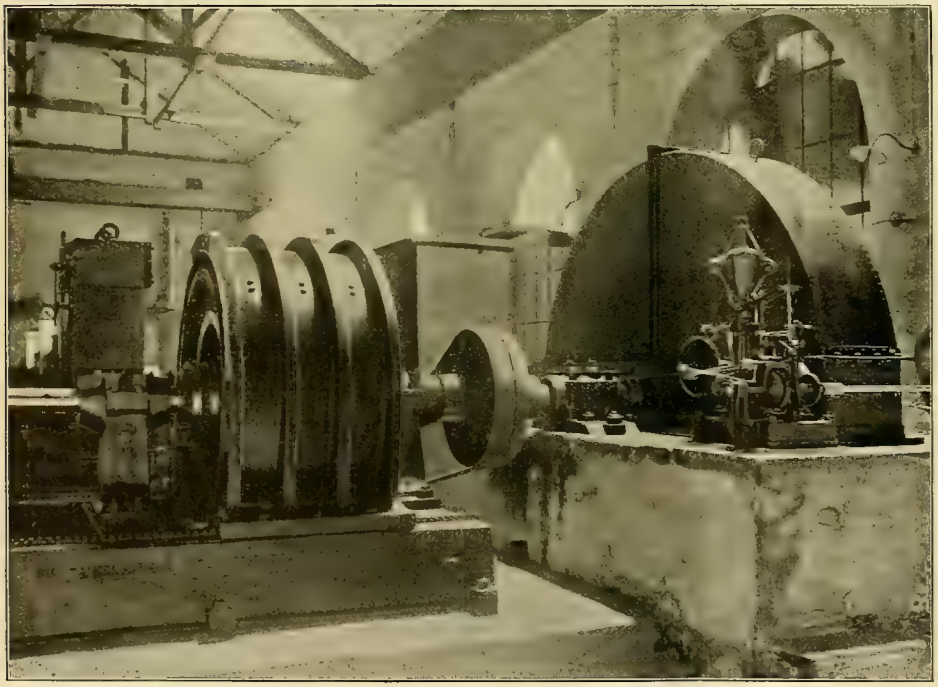


FIG. 1. POWER PLANT OF THE VALLEY OF GRÉSIVAUDAN.—DYNAMO AND TURBINE.

Inspection and Testing of Motors and Car Equipments by Street Railway Companies.[1]

By Frederick D. Perkins.

In discussing this subject I have decided to speak of inspection and testing separately. The work of inspection is to be attended to principally in the car houses, with a small amount of attention while cars are in service. The testing is to be done in the repair shop. In no direction can a railway company save money or increase dividends more rapidly than by having its equipments thoroughly inspected by competent men, working systematically, under intelligent direction.

After a car has been through the repair shop and is again placed in service, it is naturally supposed to be in first-class condition. It comes then under the immediate supervision of one or more men, presumably the day and night foremen, whose duty it is to keep that car in good condition for so long a time, with as little expense, as is possible. These men should be thoroughly acquainted with every detail of that car. Instead of examining cars once in 30 or 60 days, a daily inspection is necessary.

I have thought it expedient, for the purpose of setting forth my views on inspection, to describe the work as being carried on in a modern car house containing 50 equipments, and arranged for the easy handling of the cars, so that no extra help will be required for that purpose.

In dealing with the inspection of cars in this car house, we believe better results can be obtained by giving to each man some particular branch of the work, rather than assigning to him a certain number of cars and expecting him to do all the work required thereon. For instance, it is safe to assume that the controllers will be kept in better condition if the responsibility of a good repair be placed with one man only, than would be the case were this branch of the work made a part of the duties of several workmen in conjunction with all the other repairs found necessary. If this be true in regard to controllers, it will be found equally pertinent to all the other items of car inspection. There is also this advantage—the men will carry the tools and material for one particular kind of work only, whereas, if they had a multiplicity of duties to perform, it would necessitate their having a large assortment of tools and material, or wasting considerable time in going back and forth to the stock room.

In this modern car house five men will be required. This estimate includes only the repair men proper, and not the foreman of the car house, whose duties in connection with handling of motormen and conductors, sending out cars and similar work, would require so much of his time that he could only have a general knowledge of the work of inspection in the car house. Two of the number would be required to grease and inspect the motors, one to keep the controllers in repair, one to take care of the trolleys and to assist in the care of trucks and car bodies and one to have charge of the truck and car bodies.

The most vital parts of the equipments are the different parts of the motor, the armatures, fields, bearings, brushes and brush-holders. The care of this part of the equipment should come under the head of greasing; and on the manner in which this part of the work is done depends to a large extent the frequency with which the cars will break down while in service and also the amount of repair necessary to keep them in operation. Often the most ignorant and cheapest men are given the places of greasers. However, it is a position where intelligence and thoroughness are imperative. In order that the greaser may have sufficient time for thoroughness in detail, he should not be expected to ring alarms or attend to other matters of a miscellaneous nature, but should be held responsible for his own particular work.

The car should pass into the greaser's hands the first day after it is on the road and every second day thereafter. He should examine thoroughly brushes, brush-holders, gears, pinions, bearings and commutator. The care of the bearings and commutator is the most important, and should therefore receive the greatest amount of attention. The manner of caring for the bearings is very simple. They must be well supplied with grease or oil, and care must be taken that they are kept free from dust and grit and also that the grease feeds properly.

In the matter of the care of commutators, electricians seem divided in their opinions as to whether they should be sand-papered or not. Personally, I am not in favor of it. Instead of temporizing with the commutator by sand-papering it, and thereby simply putting it in shape for one more day's work, I would get at the bottom of the trouble and either make a new commutator (by some preparation of mica and copper which will not spark) or, if the trouble lies deeper, remedy it by remodeling the entire motor. This may seem to be a heroic measure, but the end will justify the means.

I think, however, that usually the trouble is not in the commutator, nor with the motor, but in either the brushes or brush-holder, or both; and it is probable that with proper adjustment and with proper care and treatment we should find the trouble obviated, and sand-papering of commutators unnecessary. When speaking of the treatment of

1. Read before the American Street Railway association, at Boston, September 8, 1898.

brushes, we refer to a treatment of oil or something similar.

The writer has personal knowledge of a large road where common brushes were used without any treatment or care except to replace as needed, and it seemed as if the man who used the most brushes was given the credit of taking the best care of his motor. The average life of brushes on this road, under these conditions, with the commutator sand-papered every day, was six days. Subsequently, the sand-papering was stopped entirely and the brushes were removed every six days and properly treated in oil. The life of brushes under this treatment was increased from six days to from 40 to 60 days. The trouble with commutators, which before had been great, was reduced to a minimum; in fact, it was almost entirely averted. It is possible that under some heavy conditions the practice of sand-papering must be kept up, but it must be accomplished in a different manner, and, instead of indiscriminate sand-papering, it must be used very sparingly.

Not later than every fourth day, every controller and switch comes under the notice of the man who has charge of those parts. The main point is to clean thoroughly, using a little vaseline on the contacts. The parts that are worn shou'd be touched up with a file, or should be sand-papered, and if badly worn, should be replaced, so that at least every fourth day the controllers will be sent out in first-class condition. This man can also examine the car wiring, lamp fixtures, headlights and all similar parts.

The fourth man will have the care of the trolley poles and wheels. These should be carefully looked over each night and oiled if necessary. The man who attends to this part of the equipment will also have considerable time to devote to general inspection of the car bodies and trucks, under the direction of the general inspector. Under the scrutiny of these two men should come all the details of a car body, such as grab-handles, window-catchers, curtain fixtures and similar parts. These should be carefully attended to each day, as the reputation of the road will suffer in direct proportion as these small details are neglected. The public is exceedingly exacting in relation to the manner in which its comforts are catered to in these minor details; and the degree of excellence which characterizes this part of the work will be largely instrumental in molding and fashioning its opinion of the road and of its servants in management.

The matter of car cleaning will not be considered in this paper, as it is not directly connected with the subject in hand.

After having touched upon the subject of the matter of inspection in the car house, we have to deal with outside inspection; that is, inspection of the road by inspectors, motormen and conductors. It may be a good plan to have outside inspection, and it is often advantageous, if not carried too far, but I do not believe it is desirable to have a large force. My reason is that very little of the time devoted to this line of inspection is really used in looking over the equipments, but is necessarily consumed in getting from one car to another and in waiting for opportunities, and most of the trouble located by these inspectors is not of such a nature as to require immediate attention; and if it were, the inspector could not make the necessary repairs without taking the car to the car house.

Troubles of a serious nature, such as would require immediate attention and taking the car out of service, should be easily detected by the motorman or conductor, and reported at once to the proper official. It may not be entirely irrelevant to speak here of the relation of motormen and conductors to the inspection of cars. It has been proven that it is usually a waste of time; and very little has been accomplished by attempting to instruct motormen and conductors other than in the simplest ideas of electrical problems, for while on some roads there may be a number of old motormen who have a fair idea of electrical equipments, and who might probably be allowed to locate existing trouble, it would be difficult to draw the line between the men competent in this direction and those wholly lacking in such knowledge. I know of nothing more distasteful to passengers than sitting in a car impatiently waiting while a motorman works over some part of the equipment in a vain endeavor to locate some trouble, of which he has not the faintest idea, and quite likely, at the same time, interfering with the movement of several other cars.

Of course contingencies might arise where men would be justified in attempting to locate trouble on their cars, but, as a rule, they should not be allowed to do so, as the practice is wrong. If they clearly understand the brake mechanism, the right manner in which to apply the power to the motors, how to use the cut-out switch in the controller, and have a clear conception of the general rules as promulgated by the company, this will be about as far as it is profitable to teach them.

But while we may not allow them to make repairs or experiment with the equipment, we must educate them to the necessity of being able to immediately detect any unusual or threatened condition, and to at once report the same. In fact, they must be made to feel that it is their first duty to report everything that is working to the possible detriment of the company, and if we properly im-

[Continued on page 191.]

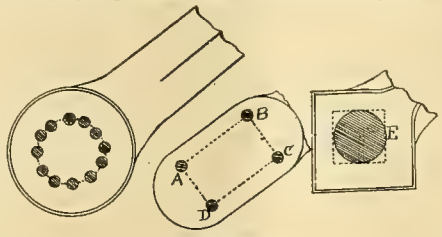
In the Electrical Repair Shop.

Crank pieces for motor shafts are sometimes received at the shop in blank form, in which case a hole or slot may be cut by drilling a series of holes, as in Fig. 1, and filing the sides smooth, after having knocked out the center. The start for the holes is easily obtained with a prick punch, using a disk of right circumference for gauging. For making an oblong slot, drill holes A, B, C and D, as in Fig. 2, and slot down both ways from A to corners C and D, and from B to the same corners with a hack-saw, following up with a file for smoo hing and squaring. The square hole is cut in several ways. A good method consists in first boring a hole in the center, as at E (Fig. 3), and then squaring the sides with a file.

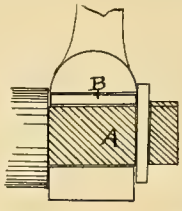
Fixing a Crank Loosened by Wear

There are two or three effective ways to stiffen a loose crank on its bearing without going to the trouble and expense of babbitting.

Fig. 4 shows a section of shaft and crank. Usually there is a bushing, and in the event of wear and consequent looseness a new bushing may be put in. Again, the ring method is used in some machines. Rough-turned rings—that is, rings with improper surface but within standard gauges of size—are ground, hardened and polished. On account of the high speed of the spindle, this ring is frequently worn out of alignment. The inspection of these rings is in itself an art. Some rings are gauged with snap gauges of slight variation, not in excess of 0.0025 of an inch, for concentricity of flange and are tested for hardness, for roughness, for smoothness of finish and for general appearance. My experience is that from 50 to 70 per cent.



Figs. 1, 2 and 3.



Figs. 4 and 5.

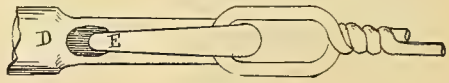


Fig. 7.

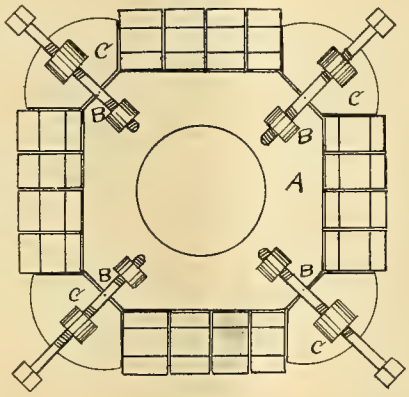
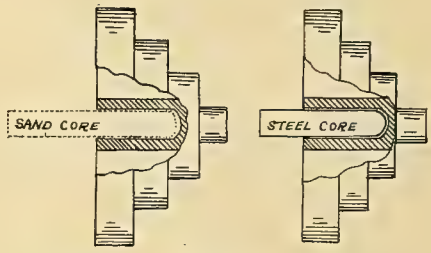


Fig. 6.



Figs. 8 and 9.

IN THE ELECTRICAL REPAIR SHOP.

of the rings examined by inspectors are approved. Two-thirds of the rings returned can be made acceptable by better finishing; a proportion of the remainder can be made so as to present one perfect flange, and about 10 per cent. of the rings sent through to the inspectors are thrown away. I will not attempt to indicate a process of making better rings, but will refer to two ways of overcoming looseness of the parts. In Fig. 4 A is the shaft. A key seat can be cut through both ring and boss for the insertion of a key B. This key should be tool steel, and shaped to effect a snug fit in the seat. If properly placed, a tight and permanent fit will result. If a crank bushing is worn it may be fixed by turning down the shaft and inserting a shell in the hub, as shown at C (Fig. 5).

Dressing Hexagon Nuts.

Hexagon nuts predominate in electrical apparatus. The method of dressing down these nuts is shown in Fig. 6. The plate A is set-screwed to a mandrel and adjusted in a lathe with the nuts flanged to it in such a way that the sides of the nuts can be dressed quickly. About 16 nuts can be dressed at the same time. The plate steel is provided with shoulders C C, which are bored and cut with threads for clamping screws. These screws lock with shoulders B B. The nuts are wedged firmly by tightening the beveled pieces with the clamping screws. Next secure the plate to a mandrel and adjust it in a common turning lathe. The sides of the nuts may be dressed down to the required shape by means of the usual cutting tools.

Wire Jointing.

Fig. 7 illustrates a new pattern of wire jointing. The piece of wire, of proper dimensions, is slightly reduced at the end, as shown at E. This reduced portion of the wire is oval in cross-section. In one side of the opposite wire is formed concave recesses D. The tongue of the hook possesses such resiliency that its point can be raised so as to permit of the slipping of one of the wires of the eye. This method permits the unhooking of the connection when required.

Cast Iron Holders.

The plate holder may be a necessary evil in some cases, the use of which should be avoided when possible. The three-screw adjustment has several advantages over the plate holder. The plate holders are constantly getting out of place. With the three-screw adjustment a wire joint out of round can be brought so nearly into roundness as to be practically perfect, and the fact that it will stay where you leave it is of great value. A solid ring or double-flange ring in a cast-iron holder is neat and clean. The plate holder is a dirt-catcher.

Connecting Rods

It is necessary that great care should be used in the selection of connecting rods to secure only those of uniform quality and freedom from all foreign substances, as any inferiority in the quality or uniformity of the stock cannot fail to make its presence known. Although great care is usually taken in testing this stock before it is drawn, it frequen ly happens that a piece which has passed every inspection, and which, to all appearances, is right in every particular, will work its way through all the processes of manufacture until nearly the very last, that of tempering, when it will turn out to be inferior. Hence the necessity of careful inspection in the shop previous to using the material.

Steel Cores.

Electrical repair-shop machinists are frequently required to cast small pulleys. I wish to refer to the cores used. While there are many places where sand cores are superior to steel cores, there are places in which steel cores excel. Fig. 8 shows a design of pulley-shaft bearing, in which the writer had difficulty in getting a proper fit with a sand core. After spoiling several pulleys I tried a steel core, as illustrated in Fig. 9, and obtained a perfect fit the first time. The steel cores can be turned down from moderately soft stock. The gain is in the labor saved after the pulley is cast. Jig work, turning and finishing are dispensed with, as the bore in the pulley is in shape for immediate use on its shaft.

F.

Chicago Electrical Association Meetings This Fall.

The Chicago Electrical association announces a programme of unusual interest for the coming four months, as follows:

October 7, 1898.—"Electrical Features of the Late Spanish-American War," Thomas G. Grier.
October 21, 1898.—"Practical Points on Electrical Measurement," W. B. Hale.
November 4, 1898.—"The Electrical Equipment of a Model Printing Establishment," George A. Damon.
November 18, 1898.—"The Development of the Motorcycle," F. B. Rae.
December 2, 1898.—"Practical Points in Street Railway Engineering," W. A. Harding.
December 16, 1898.—"Wireless Telegraphy" (illustrated by apparatus). Arthur V. Abbott.
January 6, 1899.—"Telephone Engineering—Some Problems, Solved and Unsolved," S. G. McMeen.
January 20, 1899.—"Observations on Ventilating Fans," Gerard Swope.

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Wearily the English Electrical Engineer remarks that "Really there is little kudos in being styled an electrician when a wire-stretcher or a cable-layer is included in that category." Alas, how true! And yet true kudos is not to be sought in the applause of men, but rather in the approval of the still, small voices of our electrical consciences, so that, after all, we may wipe our weeping eyes and boldly cry, What's in a name?

Funerals conducted on trolley cars are no longer a novelty in Chicago or in several other parts of the country where the conditions are suitable. It is found that such funerals can be conducted with due solemnity and decorum, and as they often mean the saving of a considerable sum of money they are increasing in number. A military funeral of this character was held a week or so ago near Philadelphia. The funeral car was draped with flags and emblems of mourning, and was followed by eight cars filled with relatives and friends. This funeral attracted much attention, for it seems that the use of trolley cars is a new thing in that vicinity.

Mr. W. J. Clark's brief but interesting paper on "The Electric Railway as an Auxiliary to Coast Defense," read before the Street Railway Association of the State of New York, contains some interesting figures. Mr. Clark made a quiet investigation of the military possibilities of the electric railways along the Atlantic and Gulf coasts four or five months ago, when it was thought to be not unlikely that the information would be of immediate value. Fortunately, there was no need to utilize the electric lines in coast-defense operations, but it was discovered, nevertheless, that should the necessity arise the electric roads could be utilized to advantage at many points in forwarding troops and stores. From Calais, Maine, to Galveston, Texas, there are 92 distinct street-railway systems along the coast. They show a total length of track of 6,897 miles, and at several points their capacity for handling traffic is two or three times as great as that of the steam railroads serving the same localities. There is no doubt that the War Department is fully alive to these possibilities, and that they will be taken into account in all future schemes of coast defense.

It is rather curious that while experienced street-railway managers of the United States who have tried both systems greatly prefer electrical over moving-cable transmission, the relative merits of the two methods are still earnestly debated in Great Britain. Newcastle-on-Tyne is about to replace animal power on its street railways by some mechanical system, and the relative merits of cables and electric traction are under advisement. Two engineers presented reports—Mr. W. Colam for the cable system and the late Dr. Hopkinson for electrical operation. There are some long and heavy gradients in Newcastle, which complicates the situation somewhat, but it would seem that American experience ought to be decisive in favor of electric traction. Let the Newcastle authorities put themselves in communication with the street-railway men of New York, Chicago and San Francisco, and they may obtain figures and comparative statements of economy, efficiency and adaptability that should be conclusive. Many companies in the United States have operated both systems, and we believe that in every case the electric railway has been found to be the more satisfactory.

Among the good results of the war has been the bringing to light of many ennobling touches of unselfishness and comradeship in all classes of Americans. All the people have been drawn closer together, and we shall hear less of class distinctions for some time to come. An excellent example of this spirit of brotherliness came from New York, where the employes of the Metropolitan Street Railway company who did not go to the war petitioned President Vreeland for permission to abrogate the rigidly enforced rule that no subscriptions of any kind should be taken among the employes of the company, in order that they, having continued to earn a regular income in the service of the company during the campaign, might show their appreciation of the services of their fellow-employes to the country in the war. The rule had never before been broken, but the president issued an order permitting the collection of subscriptions under the control of the treasurer of the company. The men expected to raise about $2,000, and with this money to send their sick and disabled companions to the country, there to remain until their health shall warrant their return to the city to resume the places that have been held open for them since their enlistment. The men of the Metropolitan company show a fine spirit of delicate and considerate generosity.

The power plant of the battleship Illinois, now being constructed at Newport News, will be interesting, not only on account of its great size and capacity, but also because it will embody many improvements which have been developed as a result of the practical experience of the navy in the war with Spain. Ten thousand horse power will be utilized in propelling the vessel, and there will be an auxiliary plant for the operation of electrical apparatus, compressed-air engines and other mechanical work. A modern dynamo plant for the incandescent lighting and ventilating fans has been designed, and a separate equipment for the four large searchlights will be provided. There will also be a power circuit, and electric motors will be used for hoisting ammunition and similar work. In the refrigerating plant a ton of ice will be made every day, and cool air will be sent to all parts of the ship by means of blowers and air passages. It is expected that this will make it possible to keep all parts of the ship cool enough for the men to work in. Electricity and compressed air will be utilized to a great extent in communicating between distant parts of the ship; for instance, the engine room will be connected with the conning tower and bridge and commander's quarters by a telegraph system, a telephone and bell signals. If two means of communication should be cut off the third can be relied upon, unless, indeed, the vessel was crippled so completely that it could not be controlled. It is certainly gratifying to note that more dependence is placed upon electricity than heretofore, and that naval experts are becoming more familiar year by year with its superior features.

New conditions are constantly confronting the American people as a result of the policy of industrial expansion and the natural outcome of the growth of the country and the development of her wonderful resources. Our relations with foreign countries and our growing foreign trade make it necessary for us to conform to the ideas of the patrons whom we seek in distant lands. For this reason alone it would seem that the adoption of the metric system of weights and measures would be not only desirable, but absolutely necessary, if this country hopes to enjoy the full benefits of the achievements that have brought her into such prominence lately throughout the entire civilized world.

For several years there has been a systematic effort to secure the adoption of the metric system by Congress, and at the last session a bill prepared by Representative Hurley received favorable consideration. Other matters of pressing importance prevented final action of the house on the subject, and the measure was passed over to the present Congress, which will be called upon to dispose of the matter at an early day. It should be unnecessary to call attention to the fact that the present system of weights and measures in use in the United States militates seriously against our trade with foreign countries, for the reason that American price lists are confusing and often unintelligible to foreign merchants, owing to the different denominations used, whereas the metric system, by reason of its decimal scale, its simplicity, its international character and its unquestionable superiority to any other system of weights and measures, is worthy of universal adoption. Again, the metric system has an additional claim to consideration beyond its adaptation to the economic transaction of the common affairs of daily life, in the fact that it is used throughout the world in scientific investigation, and is understood by scientists of all classes, conditions and countries. Its use tends to accuracy and precision of thought and expression, as well as universality of comprehension. The simplicity of the system is one of its greatest merits, and it applies to every kind of weight and measure, the method of written expression being the one of ordinary numerical notation. The sole objection to the introduction of the system in this country is the claim that it would tend to disturb settled conditions, and that it might create confusion temporarily. In reply to these contentions it may be said that this country will not continue to employ any system of weights and measures that will interfere with its progress and that is not in keeping with American ideas, and that the sole consideration that will influence the country in accepting or rejecting this proposition is whether it will prove beneficial to the people and the industries, and whether the advantages will compensate for the annoyance and confusion which such a change will cause. It is the general belief, based upon the experience of other countries, that the annoyance involved is greatly exaggerated. Indeed, the best recommendation for the system is the universal approval with which it is everywhere received.

Methods of Determining the Frequency of Alternating Currents.[1]

By Carl Kinsley.

The accurate determination of the frequency is essential for the correct computation of the relations between electromotive force, current, self-induction and capacity. Since the periodicity must usually be squared, it is essential that the determination be made quickly and with but little error.

Dr. John Hopkinson was the first to use a stretched steel wire actuated by an electromagnet, and when the condition of maximum resonance was found the periodicity was calculated from the constants of the wire and its tension.

Dr. Campbell (Phil. Mag., August, 1896) proposed the use of an iron rod which was thrown into resonance in the same way. From the constants of the rod and its length the periodicity was computed. The rod, he found, could be more easily used than the wire.

Another method capable of great accuracy and easy manipulation includes the use of a telephone in the alternating-current circuit and a resonance tube by means of which the periodicity may be calculated from equations, or it can be gathered from tables already computed. (Kinsley, Phil. Mag., April, 1898.)

A very satisfactory method will be one which includes the use of a metal strip as the primary resonator, whose periodicity may be changed by means of an added weight. An electromagnet may be used as in the first two cases to set this into vibration. The periodicity can be calculated from the constants of the vibrator (Lord Rayleigh, "Theory of Sound"), or a complete calibration can by made by two determinations. It will usually be more satisfactory to standardize by actually determining the periodicity of two adjustments of the resonator. The equation to be used for that purpose is

$$t^2 = Dl^3M + Kl_1^4;$$ where

t = time of one complete oscillation,
l = distance of the sliding weight from the support,
M = mass of the slider,
l_1 = length of the vibrating rod, and
D and K are the constants of this particular apparatus, which may be either calculated or obtained by experiment.

The condition of resonance is obtained with great readiness and the determination may be made with as great accuracy as may be desired.

Sciagraph an Aid to Surgery in War.

[From the New York Sun.]

Dr. William M. Gray of the hospital ship Relief found time the other day to talk of the part that surgery has played in the present war and the influence of new scientific appliances as tested by experience in making a lot of wounded men easier. Dr. Gray is the microscopist at the Medical Museum in Washington, and was detailed by that institution for surgical work with special reference to the diagnosis of gunshot wounds by the Röntgen rays.

"One thing this war has taught," he said, "is that the probe in all its forms has gone out of use. No more searching blindly in a man's body for the bullet; no more danger of blood poisoning from the introduction into the wound of instruments of search. The fluoroscope tells us instantly where the projectile has imbedded itself, and we have only to cut it out as if it were there before our eyes. The ingenious electric probe and all similar devices have seen their day. In all future battles experts in sciagraphy will be attached of necessity to the medical corps, and the work of the surgeons will be materially assisted by their precise indications. We took out bullets by the pint on board the Relief, and almost without exception they were located by the X-rays."

The surgeon exhibited the apparatus for producing the X-rays and the operating table where the sciagraphs are made. These stand amidships in an open space ranged about with hospital cots. Dr. Gray explained that, excellent as the results have been so far, they will be better in the future, since the Relief starts on her new cruise with much improved X-ray appliances. In the developing room he showed a number of X-ray plates, such as were prepared for the surgeon's guidance.

It seemed that valuable time might be lost in making these pictures, and the doctor was asked about it.

"It is all done in a few moments," he said; "five seconds for a wound in the hand, 30 seconds for one in the foot, and not over 10 or 15 minutes for a wound through the thick pelvis. The patient is stretched out here, the X-ray bulb adjusted over the wound like this, the plate put under the limb or part where the wound is, and the thing is done. The plates are developed almost instantly. In many cases we save hours of vain searching; not infrequently we save the soldier's life."

Then he went on to tell of a case where a man was wounded in the right shoulder by a Mauser bullet, which plowed its way on around the chest walls under the deep muscles and lodged in the left arm, shattering the humerus. "Here was an odd condition, a wound in the right shoulder but no bullet; the bone of the left arm broken, but no wound. How long do you suppose it would have taken to find that bullet by probing? It did not take us one minute to find it with the X-rays. Here it is in this picture; you see it there quite plainly."

He handed over a sciagraph that showed the fractured humerus and the imbedded bullet as if the arm were transparent. It was simply a matter of a few cuts and the bullet was out.

Electricity in Naval Warfare.

Concerning the lessons of the late war, so far as they applied to the use of electricity in the navy, Lieutenant M. L. Bristol of the Texas says:

"Electrical appliances on the modern warship and in the various auxiliaries of up-to-date warfare cannot be said to have had a fair trial as yet. Certainly they have not been of any great use in either of our big sea fights, although this is not saying that they might not be of the greatest importance under other circumstances. Before war was considered a serious possibility, eminent electricians made forecasts of many new, strange and valuable uses to which electricity would be put in the next contest between civilized nations.

"Ships were to be blown up while sailing over mine fields unconnected by wires with shore battery. They were even to photograph themselves on a chart in the shore room of an operator, who would then send a direct current to the mines through salt water. Torpedoes were to be projected through the air to drop on the deck of a ship and destroy it. Electricity was to be their propelling as well as their guiding force. Now what of all this has been realized? What have we learned of mines and torpedoes? About all that is practical as the lesson from the mines in Santiago and Guantanamo harbors, of which the one on our deck is a specimen, is that submarine mines ought to be taken up and inspected at least once a month to keep them efficient. Otherwise, in tropical climates at least, mines will be so injured by general fouling and the contact pins so overgrown with barnacles that the whole thing will be useless and harmless. Not a torpedo has been exploded in the course of the war, and the attempts of the Spanish torpedo boats to get near our vessels were so quickly frustrated by the use of the searchlights that this arm of naval warfare, for which so much was prophesied, may be pronounced practically barren of results.

"It is in the operation of the searchlight, by the way, that electricity seems to have been of the greatest practical benefit. In blockading work, such as has principally occupied the American squadron off Cuba, the usefulness of the searchlight in guarding harbor entrances and sweeping the shallow inshore waters, where light-draught vessels may otherwise slip by unobserved, has proved of the greatest value. When Admiral Cervera was bottled up in Santiago harbor the Texas and the Brooklyn or some other of the fleet kept their searchlights playing on the narrow harbor entrance every night, and it would have been an impossibility for the Spanish commander to sneak out under cover of darkness, as some of his critics have suggested he should have done.

"The electric searchlight may be put down on the list as one of the modern improvements which have really a practical value in war. One of the Brooklyn's turrets has been operated by electricity instead of by steam or hydraulic power, as the turrets of the Texas are, but we have not yet heard any report as to whether this motive power was found to possess any advantages or not.

"It is a striking fact that the carefully contrived range finders and other delicately poised appliances for improving the accuracy of a ship's fire seem to have been forgotten in the heat of the conflict. So far as I have heard, the guns of the Oregon were sighted and fired in the old-fashioned way. I know that those of the Texas were, for the simple reason that our guns are not fitted with range finders. We used the stadimeter to determine the range and sighted the rapid-firers just as used to be done with the old-style gun. And yet I think that for accuracy of fire the work of the Texas' gunners left little to be desired. This, of course, is not saying that the range finder is not a most useful instrument, especially for long-distance work, but merely that it was not brought into play in the Santiago fight, nor in the battle of Manila, which was fought at even shorter range.

"The telephone is another electrical contrivance which has proved of effectual use in the recent operations. Its utility, like that of the searchlight, the great value of smokeless powder and the effectiveness of the megaphone, have been demonstrated in this war quite as unmistakably as the force of the big gun and the destructiveness of the secondary battery. But the wonderful new mine cables, boats running on wheels at the bottom of the ocean, the flying torpedoes and the current of electricity projected along a column of water, of which we read before the war, are as much in the future as ever."

The Board of Public Works of St. Paul is mapping out a larger district for using arc electric street lights for next year, and has located about 70 additional lights. It is expected that about 100 new lamps will be placed, to supersede gas and gasoline street lamps.

Long-distance Transmission of Power.[1]

By Ernst J Berg.

Considering that this paper is read before an electric-lighting association, the greater part will be devoted to power transmission for lighting, and lighting with incidental motor load.

When in the early '90's multiphase systems were introduced on a commercial scale, it looked as if the field for the simple single-phase system would be very limited, indeed; as if it should be altogether superseded by the new system; yet upon investigation of all properties of the latter, it was soon apparent that, although the multiphase systems were superior for some conditions, such as for operation of motors, they could not favorably be compared with the simple alternating-current system for lighting. Yet, although this was known and appreciated at that early day, mistakes have often been made in choosing the best system when contemplating a new installation. The reason for this mistake lies probably in the fact that it is generally assumed that alternating-current motors must run on multiphase circuits, and, therefore, even if the motor load does not amount to anything when installing a new plant, such a system has been adopted.

Except for very long-distance transmission, as will be discussed later, multiphase systems are really only excusable where power is generated a long distance from its distribution points, and there supplied in a low-tension direct-current network by means of rotary converters.

At the present stage of the art, there can be no question that every central-station man sees the advantages of parallel operation. By this is meant not only parallel running of generators in the station, but also multiple connection of the distribution system, be this direct or alternating current. This feature is most important, as well for economy as for satisfactory operation. From the nature of things, it is evident that such a distribution system could not be laid out multiphase; therefore, when alternating current is used, single phase should be adopted.

Against this argument it is often stated that in a territory where the load is scattered greatly, a secondary network cannot well be laid out, but each customer or set of customers has to be supplied from his own transformer, in which case the distribution is single-phase, regardless of whether the system is single-phase or multiphase. If a multiphase system is used, single-phase mains are brought over to the individual customer or groups of customers. This arrangement may look feasible on paper, particularly so if no investigations are made to determine the potential in these single-phase mains.

By a few calculations, however, it is readily found that although apparently everything is nicely balanced, such a system is very often much unbalanced and consequently perfectly unsuited for its purpose. But even were it possible to distribute from a multiphase system with scattered transformers on each main, it is not at all correct to install such a plant, because any well-managed power distribution must sometime increase in magnitude, and arrangements should be made so that it can be changed over to a perfect system when needs be, which is only possible where each circuit has the same phase; that is, this is only possible with the single-phase distribution from a single-phase generator.

A still further reason for not adopting the multiphase system is that by this time motors can be operated perfectly satisfactorily from a single-phase system; that is, a single-phase system such as the monocyclic system.

As referred to above, there may, however, be conditions which would warant a multiphase, or rather a three-phase installation, and these are when the distances between generating station and consuming circuit are so great that power cannot be transmitted from one to the other, except at the highest possible commercial voltage, without too great an expenditure of line copper. Under such conditions the three-phase system, which takes 75 per cent. of the single-phase or two-phase copper, and, say, about one-half as much copper as the monocyclic system, may be preferable. For shorter distances, however, where it is not necessary to run at the limit of permissible voltage, the apparent saving in copper in the three-phase system over the monocyclic system is of little consequence, since the monocyclic system can be operated with the same amount of copper at a slightly higher voltage.

Thus, excepting very long-distance transmissions, the only field for multiphase systems is in places where installations of rotary converters are warranted.

The next question of interest is the determination of proper frequency. The 60-cycle or 125-cycle lighting distributions are certainly preferable to the 25 and 40-cycle distributions; indeed, there can be hardly any question of installing anything less than 40 cycles, and such a low frequency can only be warranted by limitations in speed regulation of the prime mover. The tendency seems now to be to have direct-connected units as far as possible. Without arguing about this point, it may be assumed that the idea is correct in most cases; yet undoubtedly it is carried too far in many instances. With very large units, such as 1,000 horse power and more, there is no doubt that the direct connection is better, but we often face propositions where the

[*Continued on page 192.*]

1. Abstract of paper read before Section D, American Association for the Advancement of Science, at Boston.

1. Read before the Ohio Electric Light association at Sandusky, August 19, 1898.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Companies as Common Carriers.

Summed up in its own phraseology, the Supreme Court of Nebraska holds, in the Omaha case entitled Nebraska Telephone company against State, ex rel. Yeiser, that:

A private corporation, engaged in the business of operating a telephone plant, is a common carrier of news and intelligence.

Such a public-service corporation is charged with certain public duties, among which are to furnish for a reasonable compensation to any citizen a telephone and telephonic service and to charge each patron for the service rendered the same price it charges every other patron for the same service under substantially the same or similar conditions.

The power—the jurisdiction—to determine what compensation a public-service corporation may exact for services to be rendered by it is a legislative and not a judicial function.

Furthermore, referring to the Nebraska statutes bearing on the subject, the court says that, if they are valid, on which it here expresses no opinion, the Legislature has conferred upon the Board of Transportation not only jurisdiction to inquire into charges of extortion and unjust discrimination on the part of telephone companies, and to make suitable orders for the redress of such grievances upon the complaint of the person aggrieved, but has also invested the Board of Transportation with authority to fix and determine to what compensation a telephone company shall be entitled for any service rendered or to be rendered by it, subject to the limitation that the scale of prices fixed which the company may charge for services to be rendered by it shall not be unreasonable or unjust either to the telephone company or its patrons.

This being so, the court holds that a person who has never applied to the Board of Transportation to have it determine whether a certain charge by a telephone company is unreasonable and exorbitant, or whether what he wants to pay is a reasonable charge, the board, having fixed no scale of reasonable charges, is not entitled to a writ of mandamus to compel the telephone company to furnish him a telephone and telephonic service at what he tenders as a reasonable charge, as a litigant will not be permitted to invoke the extraordinary remedy of mandamus when an express statute affords him an adequate remedy for the redress of the grievance of which he complains.

It is also suggested by the court that had the complainant paid the compensation alleged to be exorbitant which the telephone company demanded, namely $5 a month, and then sued to recover back the excess, or all above $3 a month, it might be that the court would then have had power to determine whether the compensation actually demanded and received by the company was unreasonable.

Extensions and Improvements.

R. E. Steele of Pescadero has been granted permission to construct and maintain a telephone line from Ano Nuevo to Pescadero, Cal.

The petition of the Sunset Telephone and Telegraph company of Los Angeles, Cal., asking for permission to construct an addition to its underground conduit system on Seventh street, between Spring and Los Angeles streets, was granted.

The American Telephone and Telegraph company of New York city (the Bell Long-distance company) has filed with the secretary of state of New York a certificate of increase of capital stock from $20,000,000 to $25,000,000. The debts of the company are $3,091,106.

From advices received at the Japanese legation in Washington it is learned that the new tariff for Japan will pass into effect on January 1, 1899. Under its provisions telephones and parts thereof will be dutiable at 10 per centum. The rates will be slightly higher than they have been in the past.

The Alaska Telegraph and Telephone company, composed of San Francisco capitalists, has succeeded in securing a franchise from the Canadian government, granting it the right to construct, maintain and operate telegraph and telephone lines in Canadian territory over the Chilkoot Pass, running along the lakes and up the Lewis and Yukon rivers to Dawson.

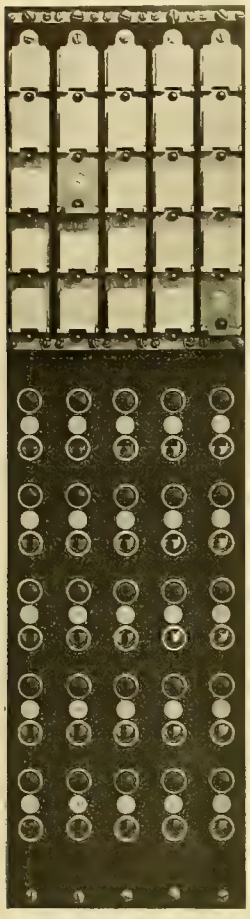
The Farm and City Telephone company of Farmer City, Illinois, has just completed an exchange in Farmer City with a hundred-drop board of the Stromberg-Carlson type. This board has all of the latest improvements and is equipped with drops and spring jacks for all the systems used. The company has 150 miles of grounded bridging, 200 miles of metallic bridging and 70 subscribers' return lines, and is now surveying for 50 miles of metallic lines to be used by farmers between Farmer City and Bellflower and Farmer City and Blue Ridge and Mansfield. B. F. Wasson, the superintendent, will go to Chicago to purchase the latest devices in telephony for these lines about October 1st. There will be 15 subscribers on each line.

Work on the foundations for the Northwestern elevated railroad of Chicago has ben resumed.

Victor Express Switchboard.

The new express switchboard of the Victor Telephone Manufacturing company of Chicago is designed for all-metallic circuits. The manufacturer claims several advantages for it. One is that there are no wires running into the jacks; other boards have from three to six wires running into each jack. Another is that one strong spring serves the purpose of all jack connections. Other claims are for simplicity and stability of parts, durability, ease and rapidity of operation and economy of maintenance.

By adopting as a basis a straight metallic system with double-circuit cords, and with the ringing and listening circuits normally cut out on both sides, an exchange using this board can easily be divided into metallic, common-return or ground circuits, and still have each division separate from the other. This is of great advantage to exchanges that wish to adopt the metallic system and gradually change over the old circuits. Owing to the mechanical construction of the Victor express board, this can be done without any change in the wiring, and as the boards are made up in complete sections, each of five complete drops, jacks and individual ringing keys, any section can be easily and quickly inserted or removed by even an inexperienced person.



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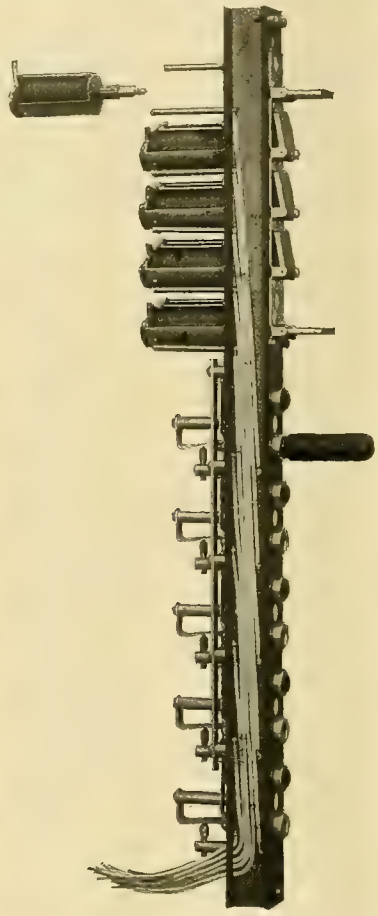

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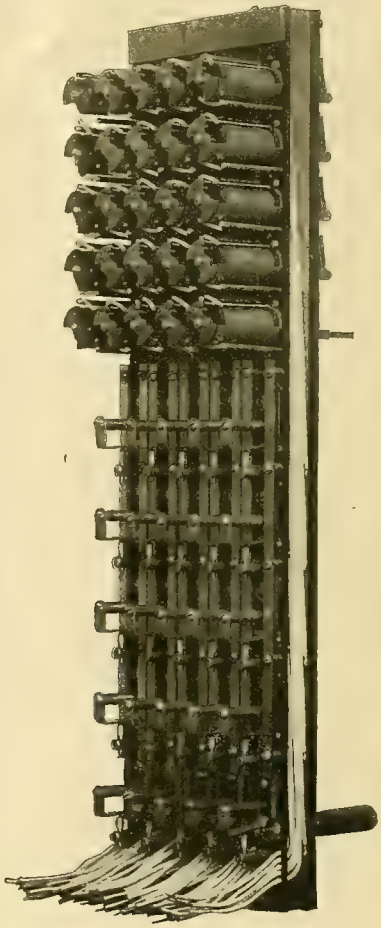

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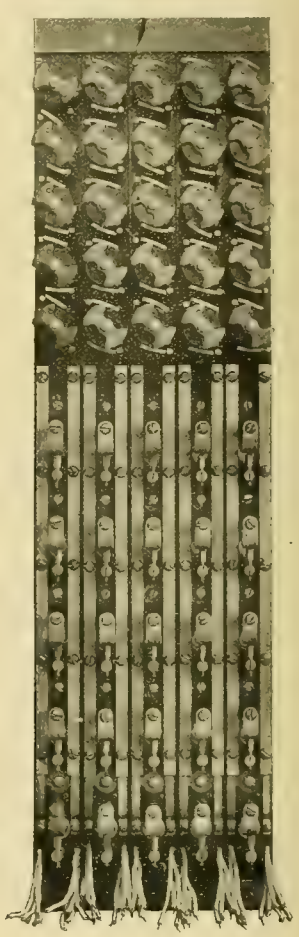


Fig. 4.

VICTOR EXPRESS SWITCHBOARD.

In Fig. 1 is shown a front view of five such sections, assembled ready for placing in position in the cabinet. The drops are arranged vertically, beginning at the top, and are numbered in the same manner or in any other way as may be convenient. For numbering little card or celluloid disks are furnished, which are pressed into recesses made in the front strip. For numbering or lettering trunk or toll-line sections, blank disks are furnished when necessary.

Below the drops are placed the jacks and ringing keys, arranged in the same way. An individual ringing key is provided for each line, so that any subscriber can be called, whether the plug is in the jack or not; or if any two subscribers are connected either one can be called without ringing back on the other line.

In the side view (Fig. 2) the arrangement of drops, jacks, keys and coils is very clearly shown, the upper coil being removed, showing the ease with which this can be done, it being merely necessary to rotate the coil one-quarter turn and withdraw it from the strip.

In Fig. 3 the wiring details and the arrangement of the several parts in general are shown to good advantage. The wiring of each section is complete in itself, all wires being concealed in a vertical groove, so that when the board is connected up no

wires either on the front or back are visible. All of the connections are, of course, carefully soldered, and the wires insulated with the best quality of rubber.

Fig. 4 shows the back of the board.

In the construction of the drop magnet several novel features have been employed. It is of the tripolar type, with the armature placed so as to obtain the highest posible efficiency. The coils are wound in even layers with silk-covered wire, and can be removed without taking out any screws. As the coils are not in series, there is no retardation or counter electromotive force to affect the telephone current. Consequently, to change to a toll-line jack, for very long-distance work, it is only necessary to replace the drop coil with one of higher resistance.

The night-bell connection is made in such a manner that there is no metal connection between the drop coil and the shutter, leaving the coils thoroughly insulated from one another, with no possible chance for leakage of current and consequent cross-talk.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The statement is given out on the authority of the Northwestern Telephone Exchange company in Minneapolis, that an agreement has been reachd with the leading independent toll-line companies to operate in harmony hereafter. The independent companies in the agreement are the Western Electric Telephone company, the Minnesota Mutual Telephone and Telegraph company, the Minnesota Central Telephone company, the Western Minnesota Telephone company, the Union Electric Telephone compan, the Southern Minnesota Telephone company and the Dakota Central Telephone company. Of these systems, the Northwestern has bought the Union Electric company, but as to the remainder, it is said to be simply a working agreement. It adds about 3,000 miles of wire to the connections available from the Twin Cities.

The Iowa Telephone company has furnished Deering Hospital, Fort Dodge, with an instrument free of charge.

W. B. Kelly of Faribault, Minn., has removed to Red Wing, Minn., where he will assume the management of the Hastings and Red Wing Telephone company.

The Wisconsin Telephone company has completed long-distance connection from Janesville, Wis., to Monroe, and the line is being extended to Dubuque, Ia.

The Pierce County Telephone company is replacing the short poles in River Falls, Wis., with longer ones, in obedience to an order of the council.

The Mutual Telephone company attempted to set its poles in the road near Mitchellville, Ia, so that the grader could not be used, but the matter was taken into court and the company soon receded from its position.

Fred Hackman of Meire Grove, Minn., wants telephone connection with Melrose, Minn., five miles. He is willing to furnish the instruments and wire if Melrose will furnish the poles.

The Perry Telephone company has completed an exchange in Adel, Ia.

The case of the city of Sheboygan, Wis., against the Wisconsin Telephone company for appropriating the use of the streets without a franchise has been dismissed from the courts. The matter now rests with the City Council, and it has not yet been decided whether the city will continue the fight or not.

The Dakota Central and Western Dakota Telephone companies announce a new schedule of rates for toll-line service.

The Chequamagon Bay Telephone company will soon open a central office in Iron River, Wis.

Messrs. Moody and Kerlin propose a telephone line to connect Park Rapids, Minn., with Menahga, via Hubbard and Latona.

Telephone Extensions in Southwestern Missouri.

The Hull Telephone company has completed its line from Bolivar to Springfield, and will soon commence work on a line from Bolivar to Buffalo, to go direct, which will shorten the present line by 60 miles.

A Christian preacher and lecturer by the name of States is now building a line to connect Greenfield, Lockwood, Golden City and Lamar.

Cane Hill has recently been added to the Hull Telephone company's lines.

Monegan Springs is now connected by telephone to the St. Clair lines at Osceola.

Work is now in progress on a line from Elkton to Pittsburg.

The question of telephone system in the city of Bolivar is now under advisement. A list of 60 subscribers has been secured. Professor Pike represents one party in the field and J. C. McKee a second.

Telephony Abroad.

The Fire Brigade committee of the London County Council has made a report, in which it says: "For a long time the question of utilizing the fire-alarm posts for the transmission of telephonic messages has been under consideration. After considerable inquiry and investigation the chief officer has devised an arrangement by means of which a portable telephone, to be carried on an engine, can be plugged into a fire-alarm post. This will enable a message from a fire to be sent by telephone, and will in many cases obviate the necessity of sending back a coachman with a written message. Arrangements have been made with the Postoffice, which provides and maintains the fire alarms for the council, to supply the necessary telephones, and to make plug-holes in the alarm posts."

The telephone service at Manchester, England, is exciting attention, and it is understood that the postmaster-general is still considering the application of the New Mutual Telephone syndicate to be allowed to set up a rival system to that of the National Telephone company.

Inspection and Testing of Motors and Car Equipments by Street Railway Companies.

[*Continued from page 187.*]

press them with the importance of these details, as outlined above, we shall have established a means of quickly locating trouble on the road, and that without the aid of special inspectors.

Next comes the matter of testing. The service which we will obtain from our equipments depends largely upon the manner in which the repairs are made. If the repair work be rushed through with the idea of going over as many cars as possible in a short space of time and with little or no regard for the thoroughness of the work, we must expect the necessity for repairs to increase to an alarming extent. If, on the other hand, we make our repairs with the idea that work thoroughly done will have a tendency to greatly decrease the liability to breakdowns while the cars are in service, and correspondingly reduce the amount of work to be done in the repair shops, we shall naturally consider the best means not only of doing the work but of definitely determining its condition when finished.

To do this properly we must resort to testing (and we use the word "testing" in a broader sense than it usually signifies). For example, all material furnished, such as tape, mica, paper, etc., must be kept up to the standard, and to accomplish this, everything used should be carefully examined, or, under our classification, tested.

We must begin testing in the purchasing department. In the purchasing of supplies a great deal of trouble is often occasioned by changing the kind of material furnished. This is probably more noticeable in the case of small roads. Now, while there may be no great difference in the quality of goods furnished, or if any one of the many different brands were used exclusively it would give satisfaction, yet the very fact that many different kinds are used has a tendency to produce a lack of carefulness in the details of the work which will almost invariably show in the general result. This will be noticeable in several ways. The workmen will take one of the following views of the matter: He will either think the management is careless in the matter, and, as a consequence, he will immediately commence to drop from the former high standard of work, or he will think that there is nothing essential about the quality of the material used and acquire the pernicious habit of utilizing anything which may happen to be handy.

When a workman once detects what seems to him to be a lack of thoroughness in any part of the work which has to do with his department, you have at that moment allowed to enter that department a spirit of carelessness which will develop very rapidly, and, unless quickly suppressed, will in a short time produce distastrous results.

To attain to a condition of thoroughness in any line of work may have called for the performance of a great deal of hard labor, the expenditure of much time and money, and the exercise of patience, skill and forethought; but how slight a relaxation of vigilance on the part of some official trusted with the maintenance of the good condition acquired can in an incredibly short space of time undo the good work accomplished and cause a retrograde movement along lines which had promised so favorably!

If, however, we have to allow only one kind of material in the repair shop, the question naturally arises as to how we can avoid being behind the times in the matter of different kinds of supplies, and also in the manner of their use. The answer is, we must have an experimental room, and here must be tested samples of all supplies and material before being contracted for by the purchasing agent. I do not mean to say that this room must necessarily be entirely separate from the repair shop, as this would naturally require a large amount of machinery which we already possess and would not care to duplicate. But this room must be considered by the employes as one in which they are not directly interested other than as they are required to work on some portion of that which is being tested. The special testing and all the instruments for it must be in a separate department; and if it is not possible to have a separate room, at least a part of the repair shop should be partitioned off for this work, as the amount of time wasted by the employes of the shop, attracted from their regular duties by the testing of some part of the equipment or material on the floor of the repair shop proper, would, if saved, more than compensate for the expense incurred in the creation and maintenance of such a room.

Having thus arranged this separate apartment for practically all testing purposes, and having impressed upon employes and workmen that herein will be settled all questions relating to work done and material used, we have accomplished one of the results aimed at, in that we have prepared ourselves to impress upon the men that any material placed in their hands for use in repairs has previously been thoroughly tested, and this will, we think, tend to raise the standard of work, as any results of poor workmanship on their part cannot then be laid to faulty material, thus giving them an incentive to conscientiously deal with established and known good material.

We are now able to take anything in the line of new material, or any new ideas regarding the use of the same, or any electrical problems which may arise, and ascertain their value without interfering in any way with the regular work of the shop or of the employes.

It is neither necessary nor desirable that the workmen should know the merits or defects of whatever comes to the testing room. But there are some of the employes who should be allowed to become familiar with a great deal of the work of this room. They will not only be more valuable for the knowledge thus obtained, but some of the work must of necessity be delegated to some other person than the electrical engineer. But at all times it must be made plain to them that the room is distinctly a separate department, having no connection with their ordinary work.

Having now provided for our testing department, and established its relation to the purchasing of supplies and to the employes of the repair shop, what machines and instruments shall we need in its equipment? I enumerate two instruments: A high and low-reading direct-current voltmeter, one having a double scale reading from 1 to 750 and from 1 to 15; a direct-current ammeter reading from 1 to 100. A low-reading ammeter would be very convenient many times, but is not absolutely necessary. A 50,000-ohm magnetic bell, an alternating-current voltmeter and some handy testing set will make an outfit of instruments with which we can do all the testing required.

If the alternating current is not within reach of the car house, we must procure a small dynamo and produce it ourselves: A very small machine, say two horse power, would be sufficient for all the needs of the testing department. If this machine is designed for about 100 volts, it would be most convenient for our use. With a few small transformers wound for 2,000 volts primary and for either 50 or 100 volts secondary, we are prepared to furnish any voltage within a range of from five volts to 10,000 volts.

The man who has this part of the work in charge can very easily and cheaply arrange the details of installation of the wiring, etc. He can also make some resistance coils and many other pieces of apparatus which will greatly facilitate the quick testing of whatever may be sent to this department.

What shall we test? First, everything that goes into the repair shop. By doing this we shall be sure of keeping all material up to the standard, which means an absolute guarantee against breakdowns caused by poor material. In this way we raise the standard of workmanship.

Second, all supplies which go to the foreman of the car houses. In connection with this matter we are of the opinion that in the testing room should be decided the manner of treating brushes, the length of time they should be used before being removed from the motor, the manner in which they should then be cared for, their final disposition, the proper attention to be given the trolley poles, the length of time they ought to remain in service and their condition when removed. Many similar questions should not be left to work out their own solution or be dependent upon the feelings or judgment of the various employes and workmen, but should be definitely determined and decided in our testing department.

Many street-railway men may be of the opinion that we are carrying system beyond necessary limits in thus definitely and positively arranging these details; but why should we allow several men to use material in whatever manner they may individually see fit, treat brushes as their fancy may dictate, and regulate the tension of trolley poles in accordance with their own feeling at the time, rather than by any fixed standard?

Third, all finished material, as armature coils, insulation for controllers, commutators and brushholders. We do not necessarily need to test every piece, but enough to satisfy ourselves that the general order of work is kept up to the standard.

Fourth, all armatures, fields, commutators and controllers, as they are being made or repaired. One illustration will be sufficient to show how the testing may be carried on in this branch of work.

An armature is wound and ready to be connected to the commutator. With a small wire we connect all of the top leads together. The bottom leads are separate from one another. With a magneto or testing set we find the insulation of the complete armature is not right. First, we cut the small connecting wire on the top leads in several places, then by testing each of these parts we locate that portion of the armature which is bad; then, by removing the wire, we will test each coil separately

until we find the weak one. Next, by the use of our transformers, we obtain three or four thousand volts, which we apply to this one coil. If it stands the test, we may allow it to go through; and if not, it can be replaced. If we should find that the trouble extended to a large portion of the armature and indicated moisture in the coils, we may, by the use of this transformer, obtain 25 or 30 volts, and by connecting the armature to the commutator with the exception of one end of one coil, and then connecting one side of the 25-volt circuit to this end, and the other side of the circuit to the commutator bar left vacant, we may apply the current for the purpose of drying the armature. This will have the advantage that the heat will be generated in the core and the armature will dry from the inside instead of from the outside.

With similar tests on all finished parts sent out from our repair shop, we have almost wholly removed the chances of failure in service, and have unquestionably added to the length of life which may reasonably be expected from our equipment.

By running a few wires from our testing room to that part of the shop where the cars are brought in for repairs, we are able to reach every part of the equipment in a quick and thorough manner, and it is probable that if a few tests are made on every car that comes to the shop many troubles will be located before they have sufficiently developed to become serious. Hence, the time required to make tests will add nothing to the pay-roll, while the benefits derived may be many. All cars should be brought to the repair shops, thoroughly overhauled and inspected at least twice a year.

In determining what shall be the standard of the work in the different branches of the shop, of finished material and of cars in service, I do not believe there can be any fixed scale. As we proceed with our testing and inspection we shall gradually raise the standard of our work, and it will only be a short time, after adopting a thorough method of doing the work, that many of the daily perplexities will have been eliminated.

Long-distance Transmission of Power.

[*Continued from page 189.*]

customer wants to install direct-connected slow-speed 75 to 100-kilowatt machines. That is, in my opinion, to carry things a little too far, since the slow speed necessitates very large and efficient alternators, with very many poles and engines, with exceedingly close speed regulation.

In order to obtain satisfactory parallel operation of alternators it is necessary that their speed be uniform, and since no steam engine of reciprocating type can be made which gives a perfectly uniform rate of rotation, it is necessary to advise in some cases generators which are most suitable for the engines. It is often possible to build a 25-cycle direct-connected alternator which will operate perfectly satisfactorily from a given steam engine, whereas if a 60-cycle alternator were installed on the same engine, its behavior would be so bad as to make parallel running prohibitive.

The amount of permissible variation is indirectly proportional to the frequency of the alternator connected to the engine, so that, for instance, if a 20-pole alternator were directly connected to a steam engine which gave a speed variation of, say, one-half per cent., and it was desired to get as satisfactory results with a 40-pole alternator, that is, with an alternator giving double frequency, it should be necessary to have one-fourth per cent. speed variations.

If belted alternators are used it is hardly ever necessary to consider lower frequencies than 60 cycles, since the question of speed variation of the engine is, of course, not of such importance as with the direct-connected engine, yet it may be given as a rule that cross-compound engines should be used wherever possible.

Since incandescent lighting and arc lighting are unsatisfactory for frequencies below 60 cycles, it is evident that we always have to consider either 40, 60 or 125-cycle systems, these being the standard frequencies, and of these the 125 or 60-cycle system should preferably be used, and the 40-cycle only when forced by the speed regulation of the engine.

Regarding the preference for 125 or 60 cycles, it is hard to give any rule. Were it not for the higher speed of the 125-cycle alternators, I believe I would favor them, particularly so if the distance of transmission is not so long that the line inductance may be objectionable, and if the secondary network is not too extensive and too large conductors are not used. Yet if there is a probability of considerable motor load, 60 cycles may be better. In connection with this it may be well to bring out the fact that 125-cycle ironclad alternators are very well suited for parallel operation.

Thus, the rule regarding frequencies may be to use as high frequency as possible, and, where no limitations are imposed by the driving power, use nothing lower than 60 cycles.

With rotary-converter installations, the question of frequency is different. There the intention is not to distribute from the multiphase alternating circuit, but only through a direct-current network. The frequency of such a system is preferably 25 cycles, since at this frequency the regulation of the engine need not be so extremely good, and the rotaries can be built with relatively slow speed. The three-phase system is, of course, preferable to the two-phase system, since it requires less copper, less lines, less switching arrangements, etc.

Sometimes, however, it is very desirable to distribute the greater part of the load by means of the rotary-converter direct-current network, and also to do some lighting in another territory. Under such conditions, it is rather attractive to install a 60-cycle three-phase plant and use 60-cycle rotary converters, in which case the lighting could be directly done from the 60-cycle mains.

Considering, however, the high speed which is necessary in connection with the 60-cycle rotary converter and also the extremely close speed regulation of the engine or turbine driving the alternator, it may not always be a good policy to use them, but I would recommend the installation of a frequency changer in connection with the three-phase 25-cycle alternating-current generator. The frequency changer can be used for transforming three-phase power to single-phase power, 25 cycles to 60 cycles, and any impressed voltage to another. So, for instance, with the frequency changer installed in Brooklyn, power is transformed from 6,600 volts, three-phase at 25 cycles, to 2,600 volts, two-phase power at 62 cycles. This frequency changer is to all appearances an induction motor driven by a synchronous motor. Its capacity is less than the capacity of a corresponding motor-generator set and its efficiency is higher.

Finally, regarding the low-potential alternating or direct-current network from rotary converters, there need hardly be any discussion, since every central-station man is fully familiar with the present methods of distributing for lighting.

Discussion.

Mr. Scovil: In ordinary small central stations, as you know them in the state of Ohio, in a case where they have a single-phase 125-cycle system and are trying to develop a power system, what would you recommend them to do?

Mr. Berg: I would recommend them to put in a high-frequency monocyclic machine, and run this in multiple with the high-frequency alternators in the station, using the two machines in multiple for lighting and motor work.

Mr. Scovil: Does that mean that outside of the station nothing will be required except the running of a third small wire?

Mr. Berg: That is all. Then you use both machines to advantage. If you contemplate an entirely new installation for very much larger field, it may be advisable to change to 60-cycle monocyclics on account of the lesser induction in connection with the 60-cycle system; yet, I think it is correct to stick to the 125-cycle system until it has been investigated whether a change should be made. I am sure we change oftener than we should.

Mr. Scovil: If they want to develop some power load, but if the main power load is lighting, the right thing to do is, then, to put in a monocyclic machine.

Mr. Schmidt: Do you say you can run monocyclics in multiple with single-phase machines regardless whether on one engine or two engines? The regulation would have considerable to do with it, wouldn't it?

Mr. Berg: Regarding parallel running of alternators, the chief condition is that they run at the same frequency, and also at the same rate of speed during each revolution. This first condition is readily fulfilled, since the speed of steam engines can be slightly varied. The second condition, however, often prevents parallel running of alternators, particularly so with high-frequency machines directly connected to slow-speed engines. Belted alternators offer, as a rule, no difficulty.

The most favorable condition for parallel running is alternators operated from independent driving power, where the size of the alternator is approximately the size of the driving power itself. Under such conditions it is only necessary to excite the alternators to the same voltage and adjust their speeds by means of a tachometer and phase lamp, and throw the machines in multiple when they are running at approximately the same speed. In this case it is hardly necessary to get a finer speed adjustment than, say, that corresponding to one flickering of the phase lamp every two seconds or so. Direct-connected alternators with sufficiently closely regulating engines are, of course, as easy to run in multiple as belted machines.

The next condition for parallel running is when two or more alternators are connected through belting to the same countershaft. Under these conditions it is, however, necessary that the speed of the alternators be closer adjusted than in the case given above, and they should not be thrown in multiple unless the phase lamps flicker at the rate of, say, one pulsation for every five or six seconds or so. Alternators operated from different countershafts, which, however, are interconnected by belts, offer a relatively easy problem if the alternators are of the same size compared with the size of the power supplied by the countershaft, but offer a very difficult problem if the alternators are small compared with the size of the power furnished the countershaft.

Under such conditions parallel running may sometimes be prohibitive, and if it shall be done successfully the pulleys have to be adjusted very accurately indeed.

The most difficult problem for parallel operation is when two or more alternators are connected to independent countershafts which are not interlinked by belts, and the size of the alternator is small compared with the size of the power given by the countershaft.

Mr. Turner: Suppose in a small station for lighting you want to put on some motors, and yet you are not warranted in putting in a large monocyclic machine to run in parallel with your ordinary single-phaser, is it practicable to put in a small monocyclic machine running parallel with your large single-phaser?

Mr. Berg: Perfectly feasible, provided you do not encounter the difficult conditions I referred to.

Mr. Turner: I mean, under favorable conditions.

Mr. Berg: Yes; it is perfectly feasible. I have made a great many experiments with all sorts of combinations of alternators; for instance, I had one not excited and the other highly over-excited, and threw them in parallel and found that it was indeed difficult not to make them catch in multiple if you had reasonably good conditions. I had, however, independent engines for the alternators, which, as stated before, makes the problem fairly simple; and I succeeded in not braking them from each other. In these experiments I used alternators of widely different outputs.

Mr. Schmidt: Then, under the conditions Mr. Turner spoke of, wouldn't it be practicable to run in parallel?

Mr. Berg: Yes.

Mr. Scovil: Do I understand you to say that it would be difficult to regulate alternators directly connected to their prime mover, that prime mover being the ordinary reciprocating engine of to-day?

Mr. Berg: Not difficult to control them. It may be difficult to operate two direct-connected alternators in multiple, if care is not taken in getting close enough speed control of the engine. This is particularly the case with slow-speed engines.

Mr. Scovil: We are putting in a 60-cycle system in Cleveland, the generators being direct-connected.

Mr. Berg: Have you a big flywheel?

Mr. Scovil: Yes, sir.

Mr. Berg: Have you ordered new engines especially built for this purpose?

Mr. Scovil: Yes.

Mr. Berg: In other words, you have looked out for the point of speed control, and have seen that the flywheel is big enough.

Mr. Holmes: Mr. Berg spoke about a difficulty in balancing and parallel connection of the low-tension network, which I understood applied to the two-phase system. I would like to ask if there is reasonable care taken in balancing the load on the two-phase whether there will be any difficulty of that kind, and if there is difficulty about what proportion it would amount to? Another thing, as to the difficulty of balancing a three-phase machine; in looking the matter up for my own information, I understood that in lighting it was very difficult, or even almost impossible, to sufficiently balance the three-phase to get reasonably good lighting service.

Mr. Berg: It is as difficult to balance a two-phase as a three-phase system. The unbalancing is partly caused by the self-induction of the machine and partly by the resistance and reactance of the wiring. Assume that we made a machine that had no self-induction whatever, which, however, cannot be done, but supposing it could be said that the generator had no self-induction, it would still be impossible to wire up a system without self-induction, or, at least, I am sure it would take considerable time to figure how to do it. It could not be done in a practical way. If you were very careful to go over every foot of wire you might be able to limit the unbalancing in voltage to one per cent. or so, but you will find in the usual way that you will get from five to six per cent. off, and that is too much. Regarding multiple connection of the secondary network, it is evident that all wiring belonging to one phase must be separated from the wiring of the second phase.

Mr. Scovil: If, as I understand, a good deal of this difficulty comes outside of the lighting system, an independent wire carried for power work would avoid the difficulty. Is that so?

Mr. Berg: Yes. Unbalancing is impossible in the monocyclic system and multiple connection possible, since all the lights are on the same phase and the third wire used only for motors.

Mr. Turner: Assuming that you have a two-phaser or three-phaser already installed, could you get good regulation?

Mr. Berg: Yes; if care is taken in balancing the circuits and if regulators are installed. I don't want to be understood to say that multiphase is entirely bad for lighting. I know it is the right thing under many conditions; but I feel that many mistakes are made in choosing two-phase and three-phase systems where it should be single-phase beyond doubt; and I hope you can see the reason.

Mr. Scovil: You seem to be good at answering conundrums, and I will ask another: From your knowledge of motor building for use on alternating systems, is it reasonable for those people who have 125-cycle machines to expect that they are going to get a good motor to run on those lighting circuits?

Mr. Berg: We don't recommend that motors be run on the lighting circuits. We would make an independent line for the motors, at least if they are of large capacity; but regarding the efficiency of the motors, we can now build as efficient motors at 125 cycles as at 60 cycles. The 125-cycle motors run, however, at a slightly higher speed, just as do alternators. A good many people do not like high

speed; therefore 60-cycle motors may be preferable; but if you don't care about speed, we can give you as good 125-cycle as 60-cycle alternating-current motors.

Mr. Scovil: Does this refer to straight single-phase with no teaser wire?

Mr. Berg: No.

Mr. Scovil: Can you get a good starting torque in straight single-phase motors?

Mr. Berg: We have built such motors which gave double full-load torque, but I do not recommend it. We furnished them to plants where they did not care about starting current, but wherever the question comes up of starting current, I don't recommend a single-phase motor with large starting torque. The time is not yet ripe to say that single-phase induction motors shall supersede multiphase motors altogether; yet I know that the progress made during the last two years is quite wonderful, and there is no reason why it should stop now.

Mr. Perkins: I presume you have read of the single-phase running at St. Louis, where they do everything from the single-phasers. Perhaps that is a city which offers opportunities in a practical way that no other city does. It has been my pleasure to see the practical operations there and a single-phase induction motor which, up to the sizes already built, has proven an entire success. The Missouri Edison company of St. Louis plans to entirely remove all its direct-current motors and operate from single-phase induction motors. I have seen some of these motors operate under most trying conditions. A factory there has three five horse power motors which have operated for three years with a daily load of 10 horse power without any bad results, stopping and starting frequently. As to stopping and starting frequently, I only recently saw a 25 horse power induction motor running a Ferris wheel—a somewhat smaller wheel, I suppose, than the original—but this Ferris wheel had to start and stop every two minutes. It has been in successful operation. I think that for the sizes up to which those single-phase motors have been developed there is not much question that it has been proven that for the operation of secondary systems, especially in large cities, and for heavy distances, where they must be interconnected, if better regulation and better service is the correct thing, they can do the work. Unquestionably, the single-phase motor has been operated successfully in St. Louis. There are enough of them there to prove that. Don't be misled by the idea that this is a synchronous motor. A single-phase synchronous motor has not been found to operate successfully except in stations where the load is uniform; and there will not be the same effect on the lights with a purely induction motor that there is with a synchronous motor. It is a purely induction motor from start to finish. It is entirely automatic. You can put the motor in the basement and operate a controlling switch from the fifth story.

Mr. Roberts: I would like to ask Mr. Perkins if he would inform us of the ratio of the starting torque on the motors just spoken of?

Mr. Perkins: I would not dare to give any data off-hand. I think Mr. Berg can explain that to you better than I can. Some of these factors in multiphase and single-phase, such as the starting torque, are generally adjusted to suit special cases, or, I think, can be adjusted so.

Mr. Berg: To a certain extent we can adjust to our wishes. There are certain limitations at present, however. In discussing here as to the lower efficiency, I referred to straight induction motors without commutators for stopping. People object to a machine with a lot of brushes.

Mr. Gwynn: I would like to ask if the 1½ horse power motors will give the service they should?

Mr. Perkins: Yes; I think they will. I don't remember of ever seeing a case of a 1½ horse power motor under those conditions. I have seen 15 horse power started up from a full load to 22½, and carried up.

Acetylene Gas for Street Lighting.

[From the Chicago Record.]

Wabash, Ind., September 25.—Charles F. Dietrich, millionaire, head of the natural-gas syndicate which owns substantially all of the gas systems, natural and artificial, in the Indiana field, to-day visited Wabash with J. A. Knapp, an expert connected with the Chicago Gas company.

After an examination of the illuminating system of the Dietrich interests here, President Dietrich gave the order to install in Wabash the first acetylene plant for city illumination in the world.

The artificial-gas service in this city has been defective for some time. As the Dietrich syndicate has a monopoly of the manufacture of calcium carbide, from which acetylene gas is successfully generated for isolated plants, he has decided to make the experiment of supplying the city, with the intention of substituting it, if successful, for coal gas in all the artificial-gas systems owned by the syndicate in the Indiana gas field.

Standardization of Machinery.

[From the London Trade Journals Review.]

Engineers in America have been ahead of us in recognizing the advantages to be gained by standardizing machinery; first of all in economical production, and secondly in providing for the duplication of parts. An English electrical contemporary admits that a thorough system of standardization brings about a temporary commercial benefit in the industry into which it is introduced, as it not only cheapens and accelerates manufacture and popularizes the products, but it improves the load-factor. This reservation, however, is added, that in a progressive industry, such as the electrical trade, "the more completely standardization is carried beyond a certain point, the more is progress liable to be impeded," and, consequently, anything more than a very limited standardization is not desirable. Commenting upon this, the Western Electrician says that the nearer we approach absolute standardization in general work the better it will be for the manufacturer, the purchaser and the engineer. American practice has proved this conclusively; and while there are special cases requiring special apparatus and special construction, there are comparatively few in the great aggregation of enterprises considered. We cannot but concur in the opinion of our transatlantic contemporary, and think that an intimate knowledge of the requirements of the service, and familiarity with existing apparatus, would prevent inexperienced engineers from attempting to develop an independent system when standard apparatus would serve the purpose at much less expense.

Electrical Toys and Novelties.

The Carlisle & Finch company of Cincinnati anticipates a great demand for electrical toys and novelties this fall. Many improvements in the

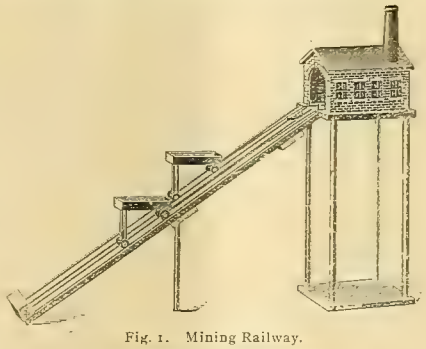


Fig. 1. Mining Railway.

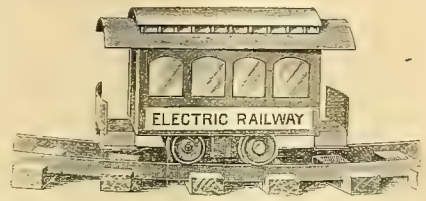


Fig. 2. Single-truck Car.

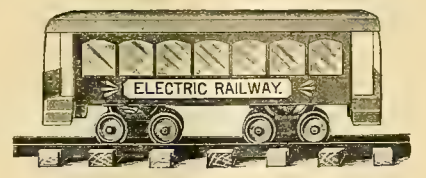


Fig. 3. Double-truck Car.

ELECTRICAL TOYS AND NOVELTIES.

miniature electric railways have been made. The small water-driven dynamos made by this company are in use all over the world. Many have been shipped to Great Britain and the Continent, as well as to Australia and New Zealand. Besides the regular line of toys and novelties the company also furnishes castings and other parts for ingenious boys to put together themselves. The armature cores are furnished attached to the shafts and ready for winding. The commutators are finished and ready to be put on the shaft. The field castings may be had either rough or finished. For show-window purposes the model railways are a great attraction. Model stations, with automatic signals, which are operated by the car as it runs on the track, may be placed at convenient points. Bridges, switches, crossings, etc., may also be used to great advantage and add materially to the realistic appearance of the scene.

Excitement in Baltimore.

[From the New York Tribune.]

Baltimore, September 12.—Rioting in which women took a leading part, caused intense excitement in the eastern part of this city to-day. It was the culmination of a long and peculiar fight between Dr. Charles Moore, a druggist, and the Consolidated Traction Street Railway company. The latter has been trying to cut two feet off the corner of Dr. Moore's pavement to lay a curve. For a month the doctor, his wife or some friend of the family has occupied a seat day and night on the corner to prevent workmen making the cut.

The railway men to-day resorted to force. A crowd of upward of a thousand people collected to watch developments. The railway men tried to rope the contested corner and keep back the crowd. Dr. Moore cut the rope. The workmen again tried to put up the rope. A lot of women grabbed hold of it. The workmen pulled and the women tugged. One big fellow jostled an excitable young matron. She slapped him on the cheek and he struck her a violent blow in the face. This blow frenzied the crowd. The police rushed for the man, as did also the crowd. "He struck a woman; kill him!" were the shouts. There were execrations on all sides. The mob was almost on him before the police could jerk him away. He resisted, but was carried off.

The crowd cut all the ropes and trooped in with threats of vengeance. A dozen stalwart men started to overtake the police, with the intention of lynching the workman. They carried the rope that caused the trouble. Reinforcements of police arrived, however, and checked the disturbance. The workmen made but little progress, and several other conflicts occurred during the day.

Assignment of the Electrical Exchange.

The Electrical Exchange, a Chicago business association engaged in buying and selling new and second-hand electrical apparatus, has made a general assignment, without preference, to L. O. Gilman. A cash offer of $1,375 for the merchandise assets of the concern has been received, and will be accepted on October 1st unless a more favorable bid is made before that time. T. S. Lane was the president of the Electrical Exchange.

CORRESPONDENCE.

New York Notes.

New York, September 26.—George J. Gould, the president of the Manhattan Elevated Railroad company, is at home, after his summer abroad. He returns with a "receptive spirit" toward the rapid-transit controversy, as he told the reporters, so that we are likely to have a reopening of the time-honored dispute. Speaking of Manhattan Elevated railroad affairs, Mr. Gould said that no proposition had been laid before him looking to the railroad passing into the control of a surface street-railroad corporation. On the contrary, he said, he proposed to institute various improvements in the system. "Do you contemplate an early change of motive power?" he was asked. "Yes; I hope to substitute electricity for the present power," he replied. "We have been looking into this matter for a long time. Electricity, I think, is the proper motive power that should be employed, and I hope to put it in shortly. Before I left on my vacation experts were preparing plans for the new equipment, and I anticipate that the reports of those experts will be ready for my consideration by this time." Mr. Gould was then told of the combination formed between the Walker and Westinghouse companies, and was asked whether the prospect of probable increased cost of equipment would interfere with his plans. "Why should it?" he inquired, in turn. "There is the whole world for competitors—not that I would go abroad to purchase the necessary equipments, because I am going to spend my money in my own country." The last statement is rather contradictory in terms, but Mr. Gould vouchsafed no further information.

Col. Eugene Griffin, vice-president of the General Electric company and colonel of the First Regiment of Volunteer Engineers, is in this city. He came on board the transport Concho from Porto Rico on sick leave. Colonel Griffin suffered from a slight attack of fever, which, combined with overwork, made it necessary for him to give up the responsibility of his command and return home for recuperation. He was confined to his bed at his home for several days, but has now recovered. None of the other officers returned to this country, and the general health of the regiment is good. The engineers have been separated into several detachments, but most of them remain at Ponce. Several companies are actively engaged in road-building not far from the coast. Colonel Griffin expects to be able to return to his command in the course of a week or so.

The Safety Third Rail Electric company of this city was incorporated at Albany last week. The company has a capital of $1,000,000, and, it is said, proposes to trade in all appliances pertaining to electricity. Its directors are Emerson McMillin, Emerson McMillin, Jr., W. F. Douthirt, C. T. Scoville, R. H. Beach, William M. Keepers, David F. Halsted, John McLeod Murphy and Louis Steckler of New York city.

Another interesting corporation is that of the American Automobile company, with a capital stock of $500,000, which has filed articles of incorporation in the county clerk's office at Elizabeth, N. J. The chief office of the company will be in Plainfield. It will engage in the manufacture of motors and other electrical appliances. M. S.

Detroit, Mich.

Detroit, September 26. Judge Henry H. Swan of the United States Court has issued an order for a preliminary injunction against the Detroit Citizens' Street Railway company, upon a showing made on behalf of the Sprague Electric Railway Motor

company. The court commands the Citizens' Street Railway company to stop infringing upon the Sprague patent for a street-railway motor. Besides this order, Judge Swan made a further order that the injunction shall be suspended long enough to enable the street-car company to remove the offending apparatus from the cars. Within 30 days 250 equipments must be removed; within 60 days 250 more, and within 90 days the remainder. Sworn statements are required at the end of each of these periods that the work has been performed as ordered. Any failure in strict obedience of this supplementary order will cause the first order, compelling the company to cease infringement immediately upon the Sprague patent to go into effect, which will stop the running of every car so equipped. Manager Du Pont of the street-car company says that he will comply with the order of the court without a fight.

When the Rapid railway was contemplated along Gratiot avenue to Mount Clemens, the company also procured a franchise for a line along Harper avenue to Leesville. The Rapid railway managers procured this franchise when they were doubtful if they could get into the city by the more direct route. When they did get the Gratiot avenue franchise the former one was allowed to lapse. The Detroit and Romeo Railway company has since secured a franchise over the latter route, and now the Rapid company, afraid of competition, has begun a fight to see if its old franchise over the road is not good. It started work on Saturday, but the sheriff soon presented an injunction, and the case will be taken to the courts. G.

Northwestern Notations.

Minneapolis, September 26.—The crossing fight between the Chippewa Valley Electric Railway company and the Wisconsin Central Railway company at Eau Claire, Wis., is still on. The temporary injunction in favor of the railroad company was dissolved on the hearing in the Federal Court at Madison. The electric company then proceeded to lay the track and make the crossing. When the injunction was dissolved the railroad company derailed a car at the point of the disputed crossing and had a gang of men to see that no crossing was made. The electric company had a few tricks also, and, leaving a few men at the disputed point, went two miles up the line and proceeded to make a crossing there. It had got pretty well along when the railroad men discovered the trick. Then an engine with a car was sent to the seat of war and was kept shifting back and forth over the crossing, effectually blocking the electric company's attempts and blocking street traffic as well. Once, however, the engineer ran too far by and the electric company's men at once laid "jumpers" and ran a car across, thus succeeding in getting its line in continuous operation. The railroad company finally secured another injunction to prevent the electric company from crossing at the new point.

Extensive improvements are to be made at the power house of the street railway company in Winnipeg, Man.

The Village Board of Sheboygan Falls, Wis., has refused to grant a franchise to the proposed Sheboygan, Sheboygan Falls and Plymouth Transit company for an electric line.

The Spokane Street Railway company of Spokane, Wash., has filed a protest with the council against that body's repealing certain franchises which the company has never used. It claims that lines are in operation where the traffic needs them, and it stands ready to build lines wherever new lines can be operated profitably, and it claims that it would be unjust to deprive it of these streets when there has been no call for lines upon them, but may be in the future.

O. M. Kirlin and W. I. Gray will establish an electric-light plant in Watertown, S. D., as soon as possible.

C. G. Edwards has sold his interest in the electric-light plant at Albert Lea, Minn., to E. A. Foote of New Haven, Conn. Mr. Foote will identify himself with the business, taking hold October 1st.

The city of Newton, Ia., has entered into negotiations with the owners of the electric-light plant for its purchase.

The council of Pipestone, Minn., summarily reduced the price of street lights from $9 to $6.75 a month for arcs. The electric-light company refused to accept the cut, and shut off the street lights at once. The company claims the council sprung the matter on it without warning, and there was no alternative but to shut off the lights.

Sarah Jacobson has sued the Twin City Rapid Transit company in St. Paul for a shock received when a trolley wire fell to the roof of the car in which she was riding. According to her complaint, the effect was to "make a great noise and a flash of light, which jarred, bruised, shocked and frightened" the plaintiff and permanently impaired her health. She desires $5,000 as compensation.

The electric-light plant at Britton, S. D., has been shut down. It is claimed that the owner has been attempting to run the mill and plant with cheap help, and the result has been unsatisfactory.

The larger stockholders of the Montana Power company, which was putting in an electric power dam at the Big Hole River, near Butte, Mont., are arranging plans to liquidate the indebtedness of the company and resume work on the dam to complete the plant. It is expected to have the system in shape to furnish power in 90 days.

C. W. McElyea, president and owner of the Cedar Falls and Normal street-car line, died at his home in Ames, Ia., on the 18th, after an extended illness. C.

Canadian Intelligence.

Ottawa, September 24.—The Hull (Que.) Electric Railway company is using salt to destroy the weeds along its line of railway. The test has proved very satisfactory. The foreman of the road suggested the idea.

The Peterboro (Ont.) Light and Power company is about to commence the erection of a large water power station. The new station will cost between $30,000 and $40,000, and the company expects to develop about 2,000 horse power.

The municipal-ownership idea has apparently not swept the city of Hamilton, Ont., for a proposal to purchase the street railway there has been rejected by the ratepayers of the city by a vote of 264 to 2,043. Hamilton has at present an arrangement with its street railway that yields the city $16,000 per annum.

The Montmorenci Power company of Quebec has been taken over by the Quebec, Charlevoix and Montmorenci Railway company, which also owns the Quebec Electric Street railway. Each original owner of stock in the power company, which furnishes light to the city and power for the electric road, receives an equal amount of stock in the new amalgamated company and the same amount of five per cent. debentures, redeemable in 20 years.

The hearing of evidence in the big electrical fight between the Royal Electric company and the Lachine Rapids Hydraulic company is now being taken before Judge Taschereau, at Montreal, and promises to last some time. The Royal Electric started the ball rolling by beginning an action for $5,000 against the Lachine company for general injury to its business by interfering with its circuits, by crossing of wires and cutting same, erection of poles, etc. The original demand was supplemented by an incidental demand of $50,000 for additional and sustained damages. The Lachine company instituted a counter action for $105,000 damages to its business and for the circulation of injurious rumors that the Lachine company was suffering from the ice, that it would be unable to carry out its contracts, and other injurious stories. These rumors, it is claimed, were of a nature to discredit and injure the company in the eyes of the community.

At the Montreal Royal Electric company's annual meeting, the reports presented were considered to be satisfactory. The gross revenue was shown to have been $955,826; expenditure, $636,057; interest and fixed charges, $42,609; net profit, $277,160. Four quarterly dividends have been declared, of two per cent. each, equalling $120,000. Ninety thousand dollars were charged to profit and loss for reduction of assets in patents; $25,000 for depreciation of plant, and $31,992 for other reasons. It was shown that the company last year made 18½ per cent. on invested capital. A dividend of eight per cent. has been paid yearly since 1891.

Since the commercial utility of electricity has been established, Canada has reason to congratulate herself on the enormous water powers available within her borders for transmission into manufacturing power. The falls of the Kootenay River, B. C., are the latest to be put in harness. The scheme contemplates the ultimate using of these falls, giving a capacity of 60,000 horse power; the present development on the middle fall (there being three falls, known as the Bennington Falls) is 20,000 horse power.

Almost simultaneously with the starting up of this plant, the Cataract Power company of Hamilton, Ont., under a generated pressure of 22,500 volts, carried a current to a transformer station 35 miles distant, for distribution. W.

PERSONAL

W. W. McChesney, Jr., representing Huebel & Manger of Brooklyn, is in Chicago.

George H. Morse, a graduate of the College of Engineering of the University of Minnesota, has been appointed instructor of electrical engineering and machine design at the University of Nebraska. He is now with the St. Joseph and Benton Harbor Street Railway, Electric Light and Power company.

Vice-president and General Manager John B. Parsons, formerly of the West Side street-railway system of Chicago, has been elected by the directors of the Union Traction company of Philadelphia to be president and general manager of the company. Newspaper rumor is to the effect that Mr. Parsons will draw a salary of $15,000.

William T. Ryle, president of the Edison Electric Illuminating company of Paterson, N. J., died suddenly at Cape May on September 21st. Mr. Ryle was a man of large means and an authority in the silk-manufacturing industry. He was a close friend of Thomas A. Edison, and his Paterson plant is considered a model one. Mr. Ryle died at the early age of 40.

The New York Sun is authority for the statement that Prof. D. C. Jackson of the University of Wisconsin has been compiling data to show the cost of obtaining a successful course in engineering. In a letter to Dr. Thurston of Cornell University, Professor Jackson says that figures already received show that one student in every 10,000 inhabitants is taking an engineering course of high grade. This proportion is double what it was 10 years ago.

Mr. William S. Hine is now connected with the Western Electric company, in charge of the sale of Stanley alternating-current apparatus in the territory formerly covered by the Chicago and St. Louis offices of the Stanley Electric Manufacturing company. Mr. Hine will give personal attention to the Western Electric company's sales of Stanley apparatus. As he is widely known and highly esteemed among electrical men, Mr. Hine is a distinct acquisition to the Western Electric forces.

ELECTRIC LIGHTING.

The Greenwood, B. C., Water Power company is constructing a dam, preparatory to the installation of a large electric-light plant.

The Navy Department, through the Bureau of Yards and Docks, is inviting sealed proposals until October 15th for installing an electric-light and power plant at the United States naval station at Puget Sound, Bremerton, Wash. The appropriation for the work is $9,800. Prospective bidders desiring specifications and details of the work can obtain them upon application to the chief of the Bureau of Yards and Docks, Washington, D. C., or to the commandant of the naval station at Bremerton, Wash.

ELECTRIC RAILWAYS.

The London correspondent of the New York Tribune states that Manchester is committed to a system of municipal operation of street-car lines and is taking measures for the purchase of suburban systems and the introduction of electric traction. Liverpool is already experimenting with electric cars on a small scale, with a view to the general introduction of this system of traction, and many other towns are moving in the same direction.

The forgings for the large engine for the power house of the Boston Elevated Railway company will be made by the Bethlehem Iron company, South Bethlehem, Pa. It is interesting to note that the shaft for this engine is to be 27 feet 10 inches long and 37 inches in diameter. It will be hollow forged, having a hole 17½ inches in diameter. The shaft, when completed, together with cranks and flywheel hub, will weigh upward of 150,000 pounds. This will be assembled at the works of the Bethlehem Iron company, and will be transported in its entirety by rail to Boston.

An exceptionally heavy rain of recent date interfered somewhat with the working of the conduit electric road in Washington, D. C. Heretofore it has been reported that the cars were not delayed when the conduits were filled with water, but it appears from press reports that the previous good record was not sustained. The conduits were filled about four o'clock in the afternoon, short-circuiting the conductor bars and resulting in melting the plow of one of the motor cars and also setting fire to some of the woodwork of the car. The damage to the car, however, was insignificant. The Railroad Gazette thinks that this occurrence should in no wise reflect on the conduit electric system, but rather on the methods of draining the conduits.

The Pacific coast newspapers state that the Los Angeles Railway company's property, which includes a system of electric street railways practically covering the entire city of Los Angeles, has passed into the hands of a syndicate of Southern Pacific capitalists, of which H. E. Huntington is the head. The details of the transaction involve the issue of $5,000,000 in bonds by the new corporation. Of this amount $4,000,000 is to be devoted to cancelling the $3,000,000 bond issue of the old corporation, to the discharge of a floating indebtedness of $400,000 and to certain improvements to be made in the property. The bonds of the new company are to bear five per cent. interest. The price paid for the property of the old company is said to have been $3,900,000.

TELEGRAPH.

A Washington correspondent notes that one of the largest telegraph bills ever rendered will soon be presented to the War Department as a result of the war with Spain. Nearly all of the correspondence of the department has been carried on by telegraph, the mail correspondence having been practically abandoned. Orders for supplies, equipments, enlistments, movements of troops, mustering out, assignments of officers, transfers of men and orders of every description were sent by wire. Since the beginning of the war the small telegraph office at the War Department has sent and received 125,000 telegrams, some of which had nearly 2,000 words in them. Besides these messages thousands were delivered by the telegraph companies by messenger, and it is impossible to tell at this time the exact number of telegrams handled. It cost the government $5,000 to notify Generals Miles, Shafter and Merritt of the signing of the protocol which provided for the suspension of hostilities.

ELECTRICAL SECURITIES.

A certificate showing an increase of the capital stock of the Commercial Cable and Telegraph company from $100,000 to $500,000 was filed with the secretary of state of New York at Albany on September 23d. The debts and liabilities of the company, the certificate states, amount to $15,000,000.

The Edison Electric Illuminating company of New York reports gross earnings for August of $202,516, an increase of $32,169 as compared with the same month of last year, and net $67,692, an increase of $1,470. For the eight months ended August 31st the gross earnings were $1,940,639, an increase of $379,072 as compared with the corresponding period of last year, and net $819,452, an increase of $122,481.

MISCELLANEOUS.

A new and important invention was tested at the German naval maneuvers last week. It was in the shape of a Greek-Phœnician fire, invented by a Berlin engineer. It ignites on contact with the air or water, and cannot be quenched by either water or earth. It burns with a brilliant flame exceeding big searchlights, and it can be sunk under water or underground and when brought to the surface instantly bursts into flame at any desired point. It was tested during the night evolutions off the Island of Heligoland and off Kiel, and proved most efficient in detecting the presence of the enemy.

Mr. Churchill, British consul at Para, in a recent report says that in 1896 the value of the rubber export from Para was nearly £3,500,000, of which Great Britain took over £1,750,000, nearly the whole of the remainder going to the United States. The quantity was 15,226 tons, the total export from the Amazon being 20,981 tons, the balance being shipped largely at Manaos, about 1,000 miles up the river. The chief sources of production are along the great rivers and islands of the Amazon belonging to the state of Para, the valleys of the main tributaries of the Amazon, such as the Purus and Madeira, and the Amazon districts of Bolivia and Peru. Mr. Churchill states that the supply is regarded by competent authorities as inexhaustible, because the tree is being continually reproduced by nature. Some areas, such as Cameta, on the Tocantins, have become exhausted, but when abandoned for a time they recover, and many districts have not been tapped at all. The area producing Para rubber amounts to a million square miles, and further explorations will probably show that this is underestimated. The richest zones at present known are along the banks of the southern tributaries of the Amazon and on the islands in the main stream. Some of the northern tributaries have not been explored.

TRADE NEWS.

The Bossert Electric Construction company of Utica, N. Y., is manufacturing a switchboard for Kingsbury, Samuel & Co. of Baltimore, to be used in the Atlanta, Ga., postoffice.

Mr. Proctor of the Proctor-Raymond company of Buffalo, who has been spending a few weeks in Chicago, has sent so many orders to his people that they have been obliged to work overtime in order to fill them promptly.

The Wilhelm Telephone Manufacturing company of Buffalo is working night and day to fill its orders. The Wilhelm double-diaphragm transmitter is said to be an entirely new production, radically differing from anything on the market.

Mr. J. Lester Woodbridge of Boston is putting on the market an ingenious electric-wire computer, designed for the determination of sizes and weights of wire to carry a given load in amperes, either concentrated at one point or distributed in equal parts at any number of equidistant points. One of the advantages of this computer is the ability to determine sizes of wire for distributed load that will give the minimum weight of copper. Another is the ability to compute the weight of copper in such a case without necessarily getting at the sizes.

On September 24th the place of business of the Michigan Electric company of Detroit was completely destroyed by fire. Temporary quarters at 106 Woodward avenue were leased, and arrangements were made for carrying on the business as usual. The company has ordered a new stock of electrical material, such as is likely to be needed immediately, including what is required to fill orders now on hand, and, with few exceptions, it will be able to take care of all orders received. Work on the permanent quarters will be pushed with vigor.

An attractive booklet on "Electric Street Railway History" has been issued by the Westinghouse Electric and Manufacturing company. It shows the progress which has been made in the development of electric-railway apparatus. The fact that the Westinghouse company has 18,712 railway motors in operation to-day, exceeding 600,000 horse power, gives some idea of the work that has been done in this branch of the electrical field. Especially interesting are the No. 3 motor, which revolutionized street-railway practice in 1890, and the No. 49 motor, which represents one of the company's newest designs and embodies the salient features of the best that it has built.

The Dixon Crucible company of Jersey City, N. J., has published a little pamphlet entitled, "Helps in Brazing." It treats incidentally of brazing graphite, the application of which to bicycle tubes prevents the adherence of the spelter and so effects a saving in labor by making unnecessary the filing which is otherwise needful. The pamphlet, however, especially treats of the process of brazing by the dipping method, or "liquid brazing," as it is called. The brazing crucible is described, together with instruction and caution in regard to its use. Instructions are given how to build and set the necessary furnace, time required for brazing, etc. This pamphlet is of interest to all bicycle manufacturers and others who do brazing. It is sent free of charge.

Pleasant echoes of the recent street-railway convention in Boston may be found in the remarks made by those who made the trip over the Wabash from Chicago to Boston, in charge of City Passenger Agent N. C. Keeran. From start to finish Mr. Keeran was indefatigable in his efforts to further popularize his already popular road. During the trip every attention was given to the delegates and their ladies; all matters of comfort were looked to personally by Mr. Keeran; and in the matter of the dining service, especially, he seemed to be able to please everyone. Mr. Keeran was accompanied by Mrs. Keeran and his son. After the convention in Boston he went to New York on a combined business and pleasure trip. Had medals of merit been in order, it is safe to say that the Chicago delegates would have voted one to Mr. Keeran.

If anyone had predicted the present development of the electrical industries a few years ago, and had said that this great country would soon contain a network of wires, radiating in every direction, and connecting cities, towns, villages and hamlets, he would no doubt have been set down as a visionary; yet few people to-day appreciate the enormous number of miles of bare and insulated wire that is in constant daily service in various parts of the country. The telegraph system requires for its operation many thousands of miles. The later introduction of the telephone has resulted in an enormous increase, which, coupled with the electric-lighting systems in use almost everywhere, has compelled the employment of an enormous amount of wire of one kind or another, and the end is not yet, for each year new advancements in the electrical field still further develop the demand. The wire industry has undergone a great change in late years, and to-day there are several very responsible manufacturers turning out the highest grade of material. The use of rubber-covered wire has increased to an extraordinary degree in the last few years, and as the underwriters' rules became more stringent, the demand upon the manufacturer for a high-grade article became more urgent, necessitating upon his part the use of not only the best material, but the highest grade of workmanship. There are several manufacturers of rubber-covered wire, but the Western Electrical Supply company of St. Louis, Mo., has found in its business experience of many years that the well-known Paranite brand of wire, for which it is agent, seems to combine more desirable qualities than almost any other wire made, and the reported phenomenal sales of the Western Electrical Supply company for this particular wire would seem to indicate that the public is fully appreciative of its good qualities.

BUSINESS.

The Kokomo Telephone and Electric Manufacturing company of Kokomo, Ind., has issued a neatly printed and well illustrated catalogue of its products—instruments, switchboards, lightning arresters, magneto bells, bridging bells, induction coils, batteries, etc. The Kokomo mild microphone transmitter is briefly described.

The New Britain Machine company of New Britain, Conn., issues two well executed catalogues—one describing the Case automatic high-speed engine and the other the company's chain-saw mortiser for woodworkers. The Case engine is well known and is often directly connected to small dynamos. It is in steady demand and has an excellent reputation.

The Buckeye Electric company says that the Buckeye special coiled-filament lamp represents that which all up-to-date lamp manufacturers have striven to produce, namely, a lamp which shows practically a straight-line curve for 500 to 600 hours when burned at normal voltage. A large stock of lamps is carried at the Chicago office, 753 Monadnock building. Prompt deliveries are assured.

Even though, according to the calendar, the summer is at an end, the demand for Western Electric fan motors continues. The public has become educated to the advantages of good ventilation, and the fan motor has been found to be one of the best means of preventing stagnation of air. It is also useful for drying purposes in photograph galleries, engraving establishments and laundries. It is noted, too, that the same company, which carries a complete line of iron-armored conduit, has recently increased its stock of fittings for conduit.

Holmes, Booth & Haydens, Waterbury, Conn., are making extensive repairs and additions in their plant. The Berlin Iron Bridge company, East Berlin, Conn., has secured the contract for the steel roof work for the boiler room, 40 by 80 feet; the new muffle room, 35 by 80 feet, and the new brass mill, 118 by 90 feet. These new additions are to be fireproof throughout. The side walls are of brick, the roof supports of steel and the covering corrugated iron. The roofs are arranged with skylights for lighting the interior of the building and monitors for ventilation.

The Electric Appliance company has taken the general western agency of the Utility Shade company, manufacturer of the Utility shade in paper and celluloid. These shades are something quite new in the electrical line and seem destined to be widely used, as they possess many points of merit, among which may be mentioned the following: They are very light in weight, neat in appearance and practically indestructible. They require no separate shade holder and are low in price. They are made in a number of different shades and colors. The Electric Appliance company has issued a special catalogue of these goods, which it will be pleased to send to the trade upon application.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 20, 1898.

610,887. Automatic Circuit-breaking Switch. William F. Bossert and William D. Pomeroy, Utica, N. Y. Application filed July 12, 1897.

The distinguishing feature is an electrical catch for securing the switch in open position, the catch being operated by a normally open subcircuit closed by the switch in open position with reference to the main circuit.

610,894. Electric-railway Car Truck. George J. Capewell, Hartford, Conn. Application filed June 14, 1898.

A car truck having a pair of central traction wheels arranged one behind the other to run upon a single-rail track, an axle for each traction wheel, motors arranged concentric of the axles on each side of each traction wheel, and a truck frame with central recesses for the traction wheels and a closed chamber on each side for each motor, supported by the axles.

610,895. Controller for Electric Motors. Frank E. Case, Schenectady, N. Y. Application filed April 2, 1898.

The combination of four or more electric motors, a switch for operating the motors in series or parallel as may be desired, and cut-out switches, one for each motor, the combination of contacts and connections being such that when the cut-out switch for any motor is operated, the remaining motors will be operated only in parallel.

610,898. Electric Arc Lamp. Max Harris, New York, N. Y. Application filed October 27, 1897.

Means for lowering the inner globe through an opening in the outer globe of an enclosed arc lamp are described.

610,899. Electric Meter. Caryl D. Haskins, Newton, Mass. Application filed June 24, 1898.

In this meter an armature is in shunt to the mains and the field coils are in series with the load; a starting coil is also in series with the armature and in shunt to the mains; means for changing the current flow in the starting coil without affecting that in the armature circuit are also provided.

610,903. Circuit Breaker for Three-wire Systems. Edward M. Hewlett, Schenectady, N. Y. Application filed September 7, 1897.

A circuit-breaking device for a three-wire system, comprising a main switch designed to act upon a circuit of a given dynamo and a relay device connected across and to each of the outside mains of the three-wire system and in circuit with a coil upon the main switch, the relay device provided with contacts closing the circuit of the coil on the main switch on excess of load in either side of the three-wire system.

610,904. Safety Device for Dynamo-electric Machines. Edward M. Hewlett, Schenectady, N. Y. Application filed April 4, 1898.

The combination with a dynamo and the prime mover, which drives the dynamo, of a mechanism electrically connected with the dynamo and mechanically connected with the governor of the prime mover, whereby upon an excessive speed being attained, the governor acts to automatically stop the prime mover and cut the dynamo out of circuit.

610,907. Apparatus for Electroplating Articles in Bulk. Georg Langbein, Leipsic, Germany. Application filed January 22, 1898.

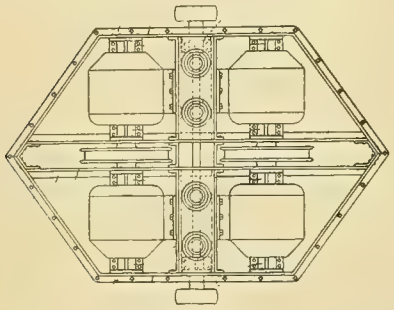
In combination, a tank, an open-top cradle, a bar, hangers insulated from the bar and extending down therefrom to pivotally support the cradle, anodes extending down from the bar into the open-top cradle, cathodes in the cradle, electrical connections and means for rocking the cradle on its pivots.

610,908. Electric Brake. John B. Linn, Schenectady, N. Y. Application filed January 7, 1898.

One claim provides for the combination, with a number of dynamo-electric machines each provided with a magnetic brake shoe controlling the axle connected to its armature, of means for passing through the field of any given dynamo the current from the armature and brake circuit of another axle.

610,909. Rail Bond. John E. Lloyd, New York, N. Y. Application filed November 12, 1896.

In a rail bond the combination with the rail and wire of a flanged washer adapted to surround the wire and be inserted in the rail from one side, and means for forming a flange on the washer on the opposite side of the rail by drawing the wire into the washer.



NO. 610,894.

610,913. Boiler-feed Regulator. Charles B. Mitchell, Hays, Texas. Application filed November 24, 1897.

The suction valve located in the suction pipe of a boiler is arranged to be opened for the admission of air to the pipe to break the suction to the pump; there is an electric circuit having a magnet in operative relation to the suction valve for controlling the latter; a vertically movable gravity vessel has connections with the steam and water spaces of the boiler; means are provided for counterbalancing the vessel, and a circuit closer movable with the vessel is arranged to close the electric circuit on the descent of the vessel due to the gravity of the accumulated liquid therein.

610,928. Electrostatic Measuring Instrument. Elihu Thomson, Swampscott, Mass. Application filed March 27, 1897.

In a static measuring and indicating instrument the combination of stationary inductors and a vibrating needle, the vanes of the needle being segments of a cylinder, with a permanent magnet whose lines of force cross the path of one of the vanes of the needle substantially at right angles thereto.

610,982. Electric Locomotive. William S. G. Baker, Baltimore, Md. Application filed November 24, 1894.

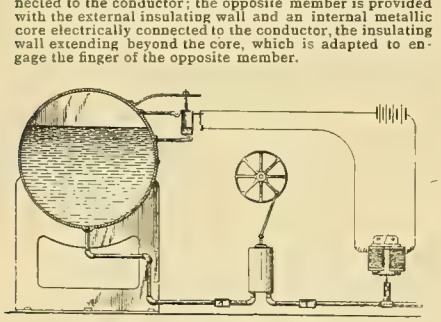
In a truck frame a motor is centered on one of the axles; a transverse frame is supported on the side beams of the truck between the axles; longitudinally arranged side bars are suspended from the transverse frame below the plane of the axles and connected with the motor between its front and rear ends and below the armature shaft.

610,999. Electric Heater. James F. McElroy, Albany, N. Y. Application filed March 18, 1895.

An electric heater consisting of a casing provided with a perforated portion adapted to fit in an aperture of the riser of a car seat and having a recessed lower portion adapted to fit behind the riser and below the aperture therein, flanges adapted to secure the front edge of the perforated plate, a resistance placed within the heater, a casing inclosing the resistance at the top and back thereof, bracket supports adapted to sustain the casing and perforated plate upon the floor of the car, with a car-seat riser entirely closed except for the apertures in which the perforated plate is placed and a car body having a seat arranged with passages between the seat and the outer wall of the car.

611,000. Electric Coupling. James F. McElroy, Albany, N. Y. Application filed January 9, 1896.

An electric coupling device consisting of two members, each of which is connected to a conductor; one of the members carries a finger mounted in an opening formed in insulating material; this finger is depressed below the ends of the insulating material and is electrically connected to the conductor; the opposite member is provided with the external insulating wall and an internal metallic core electrically connected to the conductor, the insulating wall extending beyond the core, which is adapted to engage the finger of the opposite member.



NO. 610,913.

611,001. Electric Heating System. James F. McElroy, Albany, N. Y. Application filed July 6, 1896.

An electric motor connected to the running gear of a car is combined with a controller, a switch and electric heaters suitably connected; there is a handle or lever, and an idler lever adapted to be operated by the handle; a switch arm is adapted to rotate the switch, and a controller arm is adapted to rotate the controller; the idler is adapted to engage with the switch arm and with the controller arm respectively; a guiding support is provided for the idler; the movement of the handle causes the idler to engage with the switch arm or with the controller arm, depending upon the direction of movement of the handle.

611,006. Combined Generator and Steam Engine. Marcy L. Whitfield, Memphis, Tenn. Application filed November 16, 1897.

The second claim is as follows: A field magnet or pole piece of relatively large mass having its interior hollowed so as to constitute a relatively small piston chamber, whereby the heat produced by steam within said chamber will be radiated by said pole piece, and an armature rotatable with respect to the pole piece, in combination with a piston, suitable valve mechanism, and connections between the piston and armature.

611,012. Electric Battery. Victor Jeanty, Paris, France. Application filed October 21, 1897. Patented in France November 19, 1896.

An electric battery comprising a receiver, an electrode in the receiver, a non-conducting and impervious trough located in the receiver and closed at the bottom and open at its upper portion, and another electrode in the trough, the upper-edge portion of the trough being at approximately the same level with the upper edge of the electrode in the receiver.

611,056. Electric-railway Construction. William Chapman and Percy W. Davies, Pittsburg, Pa. Application filed November 23, 1897.

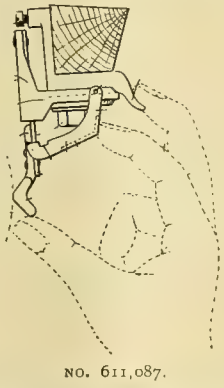
In a contact rail for electric railways comprising sections insulated from the ground and from each other, guide clamps fastened to the ends of the rail sections and insulating blocks having extensions and located between adjacent rail sections, the guide clamps having limiting stops to prevent the complete withdrawal of the insulating block extensions.

611,087. Contact Finger for Controllers or Electric Switches. Thorsten von Zweigbergk, Cleveland, Ohio. Application filed February 23, 1898.

A base adapted to be secured to a suitable stationary block, a frame secured to the base, a spring held in place by the frame, suitable walls or stops carried by the frame and adapted to limit the movement of the spring in either direction, and a contact knob carried by the spring.

611,088. Governing, Reversing and Braking Controller. Thorsten von Zweigbergk, Cleveland, Ohio. Application filed February 23, 1898.

The combination, with a pair of motors and a controller, of a reversing switch having contact fingers and contact plates adapted to connect the motors in one direction or in the reverse direction, and having a contact finger connected with the field of one motor and a contact plate adapted to connect that finger with the field of the other motor, whereby a cross-connection between the fields of the motor is adapted to be established by the movement of the reversing switch.



NO. 611,087.

611,089. Method of and Means for Controlling and Cutting out Electric Motors. Thorsten von Zweigbergk, Cleveland, Ohio. Application filed April 29, 1898.

The method of operating an electric system including two motors and a series parallel controller, when one of the motors is burned out, which consists in coupling the motors in parallel, opening the line to the burned-out motor without connecting that line with anything else, and operating the remaining motor on the parallel positions of the controller, whereby a single cut-out for each motor becomes sufficient and locks limiting the movement of the controller are unnecessary.

611,090. Controller. Thorsten von Zweigbergk, Cleveland, Ohio. Application filed April 29, 1898.

In a controller, in combination, a governing switch, a reversing switch, a reversing lever and a disengagable connection between the reversing lever and reversing switch, and means whereby such connection is disengaged whenever the governing switch is in an operating position.

611,100. Electroplating Apparatus. Hermann R. Boissier, New York, N. Y. Application filed January 14, 1898.

Features described are a tub or tank rotatable upon an upwardly arranged axis and containing the plating solution, a supporting screen of conducting material for the work constituting the cathode and arranged at a distance below the surface of the liquid, two anodes, one arranged above and the other arranged below the cathode, and means for rotating the tank and cathode.

611,142. Electric Furnace. Riccardo Pignotti, Ferdinando Lori Scipione, Regnoli, Marco Besso and Maffeo Pantaleoni, Rome, Italy. Application filed June 27, 1896. Patented in Italy May 13, 1896.

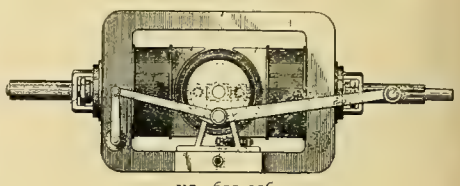
A furnace having a lining of refractory material, which is a feeble conductor of electricity; a removable carbon bottom for the furnace has an aperture through it, a carbon plug in the aperture, a lever on which the plug is mounted; a high-resistance electrode is suspended in the furnace and has a portion extended upward into the chamber communicating with the furnace; there is a receptacle for material to be treated having communication with the interior of the furnace, a screw for conveying material from the receptacle to the furnace and gas burners located in a chamber or space surrounding the receptacle, the gas burners being designed to heat the material in the receptacle prior to its transfer to the furnace.

611,148. Apparatus for Electrically Coating Wire. William S. Rawson, London, England. Application filed December 24, 1897. Patented in England March 18, 1896, and in France March 12, 1897.

An apparatus for electrolytically coating wire, consisting of a tank for containing the electrolyte liquid, an upright insulated frame arranged to be partly immersed in the liquid, a plurality of pulleys circularly arranged on the insulated frame, an anode outside of the circular pulleys, an anode located in the space within the circularly arranged pulleys, and a cathode connection arranged to contact with the wire coiled about the pulleys.

611,151. System of Electrical Distribution. Charles F. Scott, Pittsburg, Pa. Application filed October 22, 1897.

The first claim is: A system of distribution for alternating currents comprising two circuits carrying currents differing in phase and each embodying two main conductors and a neutral or balancing conductor adapted to supply translating devices in multiple series, a fourth conductor for one of said circuits connected at one end to one of the main conductors of the other circuit and a connection between the other main conductor of the last-named circuit and the balancing conductor of the four-wire circuit.



NO. 611,006.

611,162. Electric Arc Lamp. Frederic S. Worsley, London, England. Application filed March 15, 1898.

The lamp is provided with short-circuiting devices comprising, in combination with the main coil of the lamp and its core, a piece or block of magnetizable material with which the core is adapted to come into contact and short-circuit the carbons when their proper feeding is interrupted.

611,175. Galvanic Element. Robert Krayn and Carl Koenig, Berlin, Germany. Application filed June 19, 1897.

In combination, a carbon cylinder, a zinc cylinder within the same and insulated therefrom by a plug which extends up into the same and has a disk extension bearing upon the carbon cylinder; the electrolyte is between these cylinders; there is also an outer zinc cylinder about the carbon cylinder, insulated from the inner zinc cylinder and from the carbon cylinder; there is a paste electrolyte between the outer zinc cylinder and the carbon cylinder.

611,185. Rheostat. Charles H. Richardson and Lewis McMakin, Jr., Philadelphia, Pa. Application filed February 3, 1898.

The handle for turning the contact arm is provided with a dial plate, and there is an index supported in fixed relation to the rheostat case.

611,206. Circuit-interrupting Device. Daniel M. Moore, Newark, N. J. Application filed July 3, 1897.

A break wheel consisting of a metallic cylinder having plugs of glass or porcelain sealed between the contact surfaces longitudinally of the cylinder.

611,215. Electric Controller. Samuel Harris, Twinsburg, Ohio. Application filed May 2, 1898.

The combination in an electric controller of a pair of concentric shafts, a pair of switch cylinders carried thereby, two sets of fixed fingers engaging therewith and a single mechanism arranged to actuate either of the shafts.

Designs.

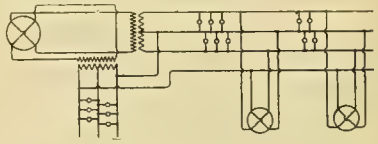
29,366. Electric Lamp. George R. MacIntire, New York, N. Y. Application filed March 18, 1898. Term of patent, 14 years.

29,367. Electric Lamp. George R. MacIntire, New York, N. Y. Application filed March 18, 1898. Term of patent, 14 years.

29,368. Electric Lamp. George R. MacIntire, New York, N. Y. Application filed March 18, 1898. Term of patent, 14 years.

29,369. Electric Lamp. George R. MacIntire, New York, N. Y. Application filed March 18, 1898. Term of patent, 14 years.

29,370. Lightning Arrester. Herbert C. Wirt, Schenectady, N. Y. Application filed August 29, 1898. Term of patent, 14 years.



NO. 611,151.

29,371. Lightning Arrester. Herbert C. Wirt, Schenectady, N. Y. Application filed August 29, 1898. Term of patent, 14 years.

29,372. Field-magnet Frame. Edward D. Priest, Schenectady, N. Y. Application filed August 26, 1898. Term of patent, 14 years.

29,373. Casing for Dynamo-electric Machines. Walter S. Moody, Schenectady, N. Y. Application filed August 8, 1898. Term of patent, 14 years.

29,375. Frame for Generating Sets. Fritz Handel, Boston, Mass. Application filed August 18, 1898. Term of patent, 14 years.

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EVERY SATURDAY.
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Cyclone in Niagara Region.

By Orrin E Dunlap.

On the afternoon of Monday, September 26th, the region between St. Catharines, Ont., on the west, and Niagara Falls and the Tonawandas on the east, was visited by a genuine cyclone that carried death and destruction in its path. The morning was very beautiful and continued so throughout the afternoon up to about 3:30 o'clock, when distant thunder announced an approaching storm. Off in the northwest a dark and peculiar cloud was seen in the sky. The thunder grew heavier and the lightning became sharp, while the cloud gathered itself in the form of a balloon and sent out two tail-like projections toward the earth. Rain fell in torrents, and sewers of ample size, for ordinary purposes, quickly became inadequate to carry off the rush of water. One of the tails of the cyclone cloud struck the earth in St. Catharines and Merritton, Ont., the greatest force being felt in Merritton. In St. Catharines the force was first felt between Lake and George streets, and from that point traveled in a direct line to the southern limits of the city, passing out at or near the Packard electrical works, from the main building of which the cornice was torn off. Several windows were blown out and an old wooden warehouse was razed and blown down the hill. Houses, barns, trees and everything in the path of the cyclone had to give way. Many peculiar incidents are related by witnesses of the damage of the storm.

In Merritton the wreckage was terrible, and four or five lives were lost. The financial loss falls very heavy on the small village. The path of the cyclone was about 300 feet wide. The cloud swept from northwest to southeast, and churches, schoolhouses, mills, dwellings, barns, etc., in its wake were left a mass of ruins. Damage amounting to over $100,000 was done to the Lincoln paper mills. Before the storm they comprised substantial brick and stone buildings, and after it there was nothing but a pile of ruins sad to behold (Fig. 2). When the storm broke over the mill there were about 80 persons in the buildings at work. The roofs were lifted and dropped upon other parts of the mill, and the walls were cracked, giving the mill the appearance of a shell-riddled fortress. Freight cars that were loaded and others that were being loaded were lifted up and swept from the tracks into the canal, upside down. Trees and buildings some distance away were white with paper from the mill after the storm.

The destruction of the public school was peculiar. This building was located on a road running east and west, and next to it, on the west, was Orange Hall. West of the hall stood the home of James Bradley, and across the street was the residence of R. Phompson. The cyclone first struck the Thompson house, carried it across the street to the Bradley house, and the two buildings crashed into Orange Hall, the entire mass falling onto the schoolhouse, tearing its walls to pieces. In the schoolhouse at the time were about 40 children, all huddled about their teacher in one corner. When the building was wrecked only one child, a little girl, was killed. The escape of the others from instant death forms one of the truly miraculous events of the cyclone.

Of one fine brick residence there was nothing left but the double parlors. The occupant of the house and her daughter were both at home, and both escaped injury.

Charles Murray of Thorold was unloading pulp at the Lincoln mills when the cyclone came up. The next he knew he was being fished out of the canal, nearly dead. His horses were killed and his wagon was wrecked.

The drill shed in St. Catharines was unroofed.

Power houses Nos. 1 and 2 of the acetylene gas-works in Merritton were partly destroyed. A picture of the wreck is presented in Fig. 1. The main building of the plant also suffered.

Many poles on the electric road between St. Catharines and Merritton were broken, and considerable wire was torn down, but Superintendent Symmes of the company made repairs promptly and caught a large travel to the seat of the storm.

David Ramsey's son was standing on the Acetylene Gas Works siding when the cyclone reached that point. He was scooped up in the funnel-shaped cloud, and after he had thrown up his arms, he was unable to get them down again. He was carried over the Lincoln paper-mill wreck and dropped in a field beyond, suffering nothing but a bruised shoulder.

Shingles were driven into the earth until they were nearly out of sight.

Mrs. John Bickley was visiting Mrs. Bradley and her daughter. Mrs. Bickley was killed, and Mrs. Bradley and her daughter were only slightly injured. The part of the city where Mrs. Bickley lived was not struck by the storm.

Many of the employes of the Lincoln paper mills were injured, several of them being young ladies.

The large two-foot poles that supported the power cables of the acetylene plant were broken off at the ground as though they were pipe-stems.

No buildings were destroyed in Niagara Falls, but hailstones of immense size fell there. This hailstorm was like a downpour of china toys, so large were the hailstones and so varied in shape and size. Some of them weighed two ounces and measured from 7½ to nine inches in circumference. Nothing like this storm has ever before been witnessed in the Niagara locality. These hailstones are illustrated in the accompanying picture, Fig. 3.

In Tonawanda several buildings were destroyed, one of the tails of the storm having swept over that locality. In one instance a stove was carried out of a house and deposited 500 feet away.

FIG. 1. CYCLONE IN NIAGARA REGION.—POWER HOUSE AT MERRITTON WRECKED IN THE STORM.

One of the highly gratifying features of the test the cyclone put things to generally, is the fact that the Niagara-Buffalo power-transmission line, which was in the direct path of the cyclone in Tonawanda, stood up unmoved and unbroken in the storm. This has pleased the Niagara Falls Power company very much, for it is good evidence that it can be depended upon to furnish a continuous service.

The Willson Carbide Works were many tons behind in their orders, and the storm will delay them still more, but the plant is being quickly put in good order. T. L. Willson subscribed $300 to the fund for the relief of the sufferers.

One interesting incident arises over the fact that the Niagara Central trestles had been reported unsafe by a government engineer. They withstood the cyclone better than anything in their vicinity.

In one house panels of an inside door were blown out as though by a chisel, while the outside doors were closed and uninjured.

In 1790 a tornado swept through the Merritton locality, and the path was cut so clean that it was turned into a public road, and to this day is known as Hurricane road.

The special committee of councilmen to consider the erection of a municipal electric-light plant at Santa Barbara, Cal., asked for by Mayor Burke, has been appointed. The estimated cost of the plant is $12,000.

Interior Electric Wiring.

By H. N. Gardner.

Many young men without previous technical training begin electrical work as helpers to electric wiremen, at the same time determined to make themselves thorough electricians by practical experience and study. The first thing that they try to find is some book that will give them information in the theoretical part of the particular branch of the work in which they are engaged. They are apt to find that the literature upon that branch of the subject is somewhat limited, and that much of it is too technical for them to understand, and more that is so impractical that they might better avoid information coming through such a channel.

It is for the benefit of beginners that this article is intended, although it is thought that there are many men who consider themselves competent wiremen who might well heed some of the ideas that will be advanced and note some of the inconsistencies and examples of poor workmanship that will be referred to.

There are many points about electric wiring that depend upon circumstances and the system of wiring followed, and these must be known before definite instructions can be given upon them. There are, however, several rules that are applicable to all systems and all conditions.

One of the first things under any system of wiring is to know how to calculate the size of wire that will be required to supply a certain number of lights giving a certain percentage of loss or voltage drop. It is surprising to learn how many wiremen there are with years of experience who do not know how to figure this, only being able to guess at it by comparing the conditions of a particular place to some other.

To make these computations, first determine the number of amperes of current that will be required with all lights of the circuit burning. Roughly speaking, it is customary to figure one ampere for every 16 candle power lamp of 50 or 52 volts, and one-half an ampere for every 104 or 110-volt lamp. Next measure the distance in feet from the entrance to the center of distribution, or about the middle lamp to be served. Multiply this length of wire by two, then multiply by 10.8 and again multiply by the number of amperes of current to be carried.

FIG. 2. CYCLONE IN NIAGARA REGION.—RUINS OF LINCOLN PAPER MILLS.

This will give the size of wire in circular mils to be used if a one per cent. voltage drop is to be figured on. If two per cent. loss can be allowed, divide the result by two, or if one-half of one per cent is all that is permissible, multiply by two. By referring to a wire table the wire number can be found.

The accompanying table shows the number of circular mils of all the common sizes of wire according to the Brown & Sharp gauge:

No. of gauge.	Area in Circ. Mils.	No. of gauge.	Area in Circ. Mils.
14	4,110	2	66,373
12	6,528	1	83,694
10	10,381	0	105,592
8	16,512	2-0	133,079
6	26,244	3-0	167,805
4	41,742	4-0	211,600

Suppose 20 104-volt lights are to be wired for, and it is found that the distance from the entrance to the center of distribution is 50 feet. To find the size of wire needed if a one per cent. voltage drop can be allowed, divide the number of lamps by two, which gives 10 amperes of current. Then, using the formula, we have 10 by 50 by 2 by 10.8 = 10,800. Referring to the table, it is found that this is about the size of No. 10 wire. Unless the result obtained is very nearly the number of circular mils in some particular size of wire, it is always better to take the size next larger.

The underwriters' rules permit of fusing somewhat heavier, but no matter what result may be obtained by this formula, it is always better not to use No. 14 wire for even a short distance to carry over seven or eight amperes; No. 12 for over 12; No. 10 for over 15; No. 8 for over 20, or No. 6 for over 30. In fact, it is better practice not to use No. 14 wire at all for light work, and some insurance inspectors insist on nothing smaller than No. 12 being used.

It is sometimes more convenient to have a table to refer to, by means of which figuring on the size of the wire can be avoided. Such tables can be found in many books of formulas sent out by wire manufacturers. A handy table is here given, from which the size of wire can immediately be found for any number of 16 candle power lights up to 100 or 333 for a 52, 100 and 220-volt service, a one per cent. loss being figured on:

52-volt Lamps.	110-volt Lamps.	220-volt System	Distance in Feet to Center of Distribution. (Wire sizes indicated in B. & S gauge.)												
			20'.	30'.	40'.	50'	60'.	70'.	80'.	90'.	100'.	120'.	140'.	160'.	180'.	200'.
1.	1.5	3.	16	16.	16.	16.	16.	16.	16.	16.	16.	16.	15.	14.	14	13.
1.5	2 5	5.	16.	16.	16.	16.	16	15.	15.	15.	14	14	13.	13.	12.	11.
2.	3.	6	16.	16.	16.	16.	16.	15.	15.	14	13.	13.	12	12.	11.	10.
3.	5.	10.	16.	16.	16.	15.	14.	13.	13.	12.	12.	11.	10.	10.	9.	9.
4.	7.	13.	16.	16.	15	13.	13.	12.	11.	11.	10.	10.	9	8.	8	7.
5.	8.	16.	16.	15.	13.	13.	12.	11.	11.	10.	10.	9.	8.	8.	7.	7.
6.	10.	20.	16	14.	13.	12.	11.	11.	10.	10.	9.	8.	8.	7.	7.	6.
7.	11.	23.	15.	13.	12.	11.	11.	10.	9.	9	8.	8.	7.	6.	6.	5.
8.	13.	26.	15.	13.	12.	11.	10.	9.	9.	8.	8.	7.	6.	6.	5.	5.
9.	15.	30.	14.	12.	11.	10	9.	9.	8.	8	7.	6.	6.	5.	5.	4.
10	16.	33.	14.	12.	11.	10.	9.	8.	8.	7.	7	6.	5.	5.	4.	4
12.	20.	40.	13.	11.	10.	9.	8.	8.	7.	7.	6.	5.	5.	4.	4.	3.
14.	23.	46.	12.	10.	9.	8.	7.	7.	6.	6	5.	4.	4.	3.	3.	2.
16.	26.	53.	12.	10.	9.	8.	7.	6.	6.	5	5.	4.	3.	3.	2.	2.
18.	30.	60.	11.	9.	8.	7.	6.	6.	5.	5	4.	3	3.	2.	2.	1.
20.	33.	66.	11.	9	8.	7.	6.	5.	5.	4.	4.	3.	2.	2.	1.	1.
25.	41.	83.	10.	8.	7.	6.	5.	4.	4.	3.	3.	2.	1.	1.	0.	0.
30.	50.	100.	9.	7.	6.	5.	4.	3.	3.	2.	2.	1.	0.	0.	0.	00.
35.	58.	116.	8.	7.	5.	4.	4.	3.	2.	2.	1.	1.	0.	00.	00.	000.
40.	66.	133.	8.	6.	5.	4.	3.	2.	2	1.	1.	0.	00.	000.	000.	000.
15.	75.	150.	7.	5.	4.	3.	2.	2.	1.	1.	0.	00.	00	000.	000.	0000.
50.	83.	166.	6.	5.	4.	3.	2.	1.	1.	0.	0.	00.	000.	000.	0000.	0000.
55.	91.	183.	6.	5	3.	2.	2.	1.	0	0.	00.	00.	000.	0000.	0000.	0000.
60.	100.	200.	5.	4.	3.	2.	1.	0.	0.	00.	00.	000.	000.	0000.	0000.	
65.	108.	216.	5	4.	3.	2.	1.	0.	0.	00.	00.	000.	0000.	0000.		
70.	116.	233.	4.	4.	2.	1.	1.	0.	00.	00.	000.	000	0000.	0000.		
75.	125.	250.	4.	3.	2.	1.	0.	00.	00.	000.	000.	0000.	0000.			
80.	133.	266.	3	3.	2.	1.	0.	00.	00.	000.	000.	0000.	0000.			
90.	150.	300.	3	2.	1.	0.	00.	00.	000	000.	0000.	0000.				
100.	166.	333.	2	2.	1.	0.	00	000.	000.	0000.	0000.					

Suppose it is desired to wire for 32 52-volt lamps, the distance to center of distribution being 70 feet. Glance down the left-hand column until 32 or the next number to it, 30, is found, then across this line to the column which corresponds to 70 feet, and it will be found that a No. 3 wire will be required. In like manner, 40 110-volt lamps for 80 feet will require a No. 2 wire.

Suppose now that lights are to be installed for the simplest kind of wiring work, open work in a store or other place of business. If an underground system of street service is used in the city, of course entrance will be made in the basement and the wires will have to be brought up to the store ceiling in some convenient place. It is more likely, however, unless the work is being done in a large city, that the street service is an aerial one. If entrance can be made from the rear of the store, so much the better, but in some places it will be necessary to make the entrance over the door or one of the windows at the store front. One rule that should be followed in all wiring work should be particularly followed in this case. Never let electric wiring disfigure a place more than is absolutely necessary. In boring holes over the door or window for the entrance wires, have the holes slope down toward the outside a little, if possible. The first thing, as near the entrance of the wires as possible, should be a porcelain fuse block. The wires should then be led to a double-pole switch. To place this within reach it will probably be necessary to run the wires part way down the side of the door casing or the side wall. In such a case it is better to use two pieces of molding. There are, however, some inspectors who try to prevent the use of molding. If the current is to be paid for by meter, do not place the meter on the side of a door casing or the side wall at a store front, as many wiremen do, much to the disfigurement of the place. Instead, persuade the merchant to pay a little more and continue the molding on past the switch to the floor, and carry the wire down to the basement, in some convenient part of which, where there is no jar from slamming doors or other cause, the meter can be placed. Return the wires to the store ceiling through another strip of molding. Of course, in doing this, the extra length of wire must be taken into account in calculating the size of wire.

Suppose that the wires are to be exposed, removed from the ceiling on porcelain cleats. If the wires are to pass from the ceiling down the side wall for a switch or any other purpose, always place one pair of cleats as near the corner as possible, on the ceiling, and another as near to them as possible on the side wall, instead of making one pair of cleats answer, as is sometimes done. If a switch is to be placed on the side wall in this manner, always place a pair of cleats not more than six inches from the switch, and remove the switch base from the wall upon a pair of pony knobs; or if small knobs are not at hand, a good substitute can be made by breaking off to equal lengths the heads of two small tubes.

Only use fuse blocks having a porcelain or mica cover, and if it is necessary in any case to place a fuse block on a side wall, it should be placed so that it is impossible for any of the molten metal to fall out unless the block is inclosed in an asbestos-lined or other fireproof box.

Never run exposed wires diagonally across a ceiling unless it is to make them conform to a strip of molding or some other feature of the ceiling. It is much better to run them square, turning all corners at right angles. Unless the wires are following the line of ceiling boards that twist, always run wires perfectly straight; and even in such cases it is usually more sightly to place the cleats all in line. If there is nothing else to go by, it is better to line up a row of cleats with a piece of cord. Before a wire is placed all kinks should be carefully removed by rubbing with a screwdriver handle or some such tool. With cleats it is necessary to run both wires at once. The wires should be stretched perfectly taut before the cleats are screwed fast. If two men are working together, it is well for one of them to stretch the wires while the other screws the cleats. A single workman can frequently fasten the wires at the farther end and then pull down on the wires while screwing them fast, and so get them taut. It is also possible to tighten a wire with pliers, using the cleat as a leverage, but great care must be exercised in this, and experience is necessary in order to avoid cutting the wire.

Cleats should be placed equally distant on both sides of and near all rosettes or cut-out blocks. Where a branch of a circuit is tapped off by soldering the wires, a tube should be slipped over the branch wire that crosses the opposite leg of the circuit. A pair of cleats should be placed on each side of the main circuit right against the branch circuit, or a single pair on the main circuit between the wires of the branch circuit may do, and another pair should be placed on the branch circuit at the end of the protection tube, to keep it from slipping. Should it be necessary to cross a gas or other iron pipe, a tube should be slipped over both wires and a pair of cleats placed close against each end of the tube. It looks more workmanlike to plan where all cleats must be placed, for some such reason as has been noted, and then divide the space between the necessary cleats into equal distances, never placing cleats more than five or six feet apart.

Not over eight or 10 lights of 104 volts or six of 52 volts should be run on the same circuit. If long rows of lights are to be run over showcases, or for some such place, it may be necessary to divide the row into several circuits of not over six, eight or 10 lights each, and then run a feeder line of larger wire along beside the row, tapping off for each small circuit from a fuse block. Rosettes should not be placed on such feeder circuits, but a branch circuit should be run to them.

Where a corner is to be turned, it looks neater to place two sets of cleats at right angles to each other, with their inner ends almost touching. The outer wire can then be bent in a graceful curve in turning the corner. Some inspectors, however, object to this short length of wire which is not pulled taut, and insist that the two pairs of corner cleats be placed parallel to each other, and the bent wires run along the sides of the cleat after they are fastened.

If it is necessary to go under several beams the wires should never be jumped across from one beam to another, but run along the ceiling with cleats close to the beam, another pair of cleats should be placed on the side of the beam near the corner and two more pairs on the under side of the beam, near the corners. If it is desired to jump from beam to beam, a board five or six inches wide can be nailed across between the beams and the wires attached to that.

In all kinds of work where a wire is spliced a Western Union joint should be made; that is, the ends of the two wires should be twisted around the other wires in turns, coming close together, instead of loose corkscrew turns. In the same manner, where one wire is tapped off from another, the turns of the jointing wire should be close together. In both cases enough turns of wire should be taken to insure a good contact, always taking at least six or seven turns of each end when a splice is made. All such connections should be soldered; and in soldering the brightened wires should have enough acid or salts applied so that the solder will sweat in well, and the wires should be heated sufficiently to accomplish that purpose. After soldering it is better to wipe off the joint with waste or a cloth to remove any acid that may remain. A common feature of poor workmanship is in not using enough tape in making a joint, and in wadding on the tape used in an unsightly manner. Enough tape should be used to give the joint at least three coats in all places, and this should be applied in even, carefully wound layers, each turn overlapping the other, care being taken to cover all parts well at the point where one wire is tapped off from another.

If porcelain knobs are to be used instead of cleats, the same rule will apply to placing them as to cleats, a pair of knobs being placed wherever it would be necessary to have cleats. The knobs should not be placed so close together that the wires will be less than three inches apart. Knobs should not be nailed up, but fastened with screws. A wire should not be attached to a knob by looping it around with a half-hitch, as many wiremen do, but should be fastened with a short piece of tie wire of the same size as the conductor wire, or in some cases it will do to have the tie wire a size or two smaller than the conductor; but small wire should never be fastened with a tie of larger wire, because by so doing the smaller wire is liable to be twisted and stretched or broken. Sometimes the conductor wires are tied so that they run along straight with the outside of the knob. It makes a better looking piece of work, however, to draw the conductor wire around with the tie wire so that it comes to the center of the knob, but such work requires more care and experience to prevent stretching, twisting or breaking the conductor wire. The tie wire should be fastened first with a single turn on each side of the knob, then fully fastened upon the side toward which the wire is being stretched, after which the other side can be fastened. At the same time, in drawing the wire to the center of the knob, care should be taken to draw it taut. The turns of the tie wires should be taken close together, the same as in making a splice, for if corkscrew turns are made the danger of twisting off the wire is increased.

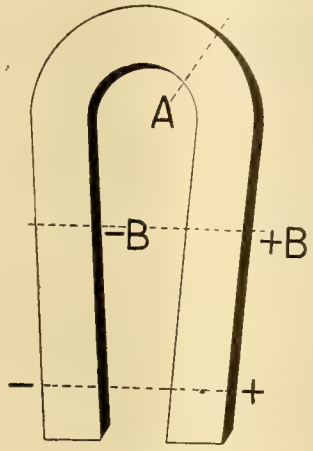
Magnetism.

By Forée Bain.

Magnetism is defined as "that branch of science that treats of the properties of a magnetic field," which is just about as indefinite to the practical mind as the definition of electricity.

While trying to impress a more lucid idea of these two forces on the mind of a steam engineer by using the usual hydraulic and steam parallel, in the course of the conversation he said he could understand steam "because he could see it." When asked, What is steam? he replied that "it is the stuff that escapes from boiling water." If the definition of magnetism were to be changed to "Magnetism is the stuff that escapes from a magnet," it would be fully as comprehensive as the present one.

The fundamental units of the centimeter-gramme-second system furnish the basis for the practical units of electricity, such as the volt, ampere, ohm,



MAGNETISM.

etc., with which we are all familiar. There are no practical units of magnetism, and no instruments by which magnetism may be measured, such as may be used in an ordinary machine repair shop. For instance, there are no such instruments for the measurement of magnetism as the voltmeter, amperemeter, Wheatstone bridge and so forth. In fact, we may compare the determination of the magnetic character of an electromagnet by the ampere-turn method to the case of the farmer who weighed his hogs by balancing them against a stone and then guessing at the weight of the stone.

There are a thousand and one reasons why the ampere-turn method is entirely unreliable. It is clumsy and indefinite, and if it ever has been of any benefit it has seen its best days of usefulness. I will not try to point out all of its defects, being content to mention a few.

If all iron possessed the same magnetic permeability, then this method of going around Robin Hood's barn might be tolerated, but the fact is that the permeability and magnetic susceptibility of iron vary with every sample. This is especially true with cast-iron. A sample bar may be taken from a casting to be "tested." The result of the test will by no means be a true indication of the permeability or character of the entire casting. The magnetic qualities of the iron are affected more or less, by "chill," crystallization, density, continuity, impurity, cross-sectional area, scale, heat, vibration and molecular structure, all of which may be varied in casting from the same heat and in different parts of the same casting.

When there is manganese in cast-iron to the extent of 12 per cent. it cannot be magnetized with the most powerful currents or electromagnets. The molecular rigidity, magnetic reluctance, magnetic inertia, coercive force, or whatever you may choose to call it, of such iron, is too great to be overcome by ampere-turns, and hence the ampere-turn theory would not apply to a core made of iron of this quality any better than it would to a core of brass.

Similar results follow, but to a smaller degree, when iron contains carbon, phosphorus, sulphur, etc., to exceed a certain small limit. The slightest trace of antimony will entirely destroy the magnetic qualities of iron which contains it.

All iron of commerce contains some of these impurities to some extent. It does not run evenly in the same brands and there are no two brands that contain the same combination.

The great variation in the magnetic susceptibility of iron accounts for a correspondingly great variation in the capacity of dynamos and motors of the same type and size. Every constructor of such machines has noticed the wide difference in the speed, voltage, etc., of dynamos of the same type, each having the same number of ampere-turns, but one having from 10 to 25 per cent. greater capacity than the other.

What we need in a shop where electrical apparatus is made and repaired is instruments which will measure magnetism as accurately as our electrical instruments do in the case of electricity.

A magnetic unit, for instance, should equal the product of the ampere into the turns per square-inch section of pure iron. Then, having the ampere turns, we could check the magnetic units indicated for magnetic permeability.

The writer has found the old Ayrton & Perry spring voltmeter to be of assistance when used as a magnetometer. The helical spring core will be drawn down by the magnetic pull of a dynamo pole-piece, when the instrument is set thereon, and the index hand will indicate the comparative strength of the two field magnets. Although it was a crude instrument for this purpose, it was of great value in the absence of something better.

Being firmly convinced that the professors and savants who are retained by our many institutions of learning have not explored the magnetic field as thoroughly as the subject warrants, I am constrained to offer a few suggestions, such as I have gleaned from probably a superficial but practical observation of the subject. These professional gentlemen have been content to wander in the forest of this wonderful phenomenon, if I may use the figure, following in the paths blazed by the earlier and more original investigators. From the many journeys through these beaten tracks there has not been anything of much value dug up for the benefit of the practical worker for many years.

The absolute units of magnetism, the dyne, the erg, etc., are of very little benefit to the practical constructor, operator or repairer of electrical machinery. They may express the magnetic strength, potential, reluctance, etc., and they may be perfectly understood by the ultra-scientific, but the practical man has no use for them unless he has an instrument, and a practical portable instrument at that, by which he can measure definitely and directly in magnetic terms the results which he wishes to determine.

It is probably safe to say that 90 per cent. of the work done through the agency of electricity is accomplished by the operation of some electromagnetic device. Magnetism that produces these results is not, however, for the above reason, directly measurable in definite magnetic units.

Magnetism is one of the primary causes of induction and is guessed at or approximated by measuring in practical terms the current and effects that produce it.

The hypothetical theory that so many lines of force per square inch at the point of saturation indicate the permeability of the magnetic subject is just about as intelligible to the ordinary worker as if the statement were written in Sanskrit. What our friend needs is an instrument like a voltmeter, one that he can manipulate and with which he can directly measure the strength of a magnet; then he will have a fair comprehension of the subject.

Until this has been done, the most successful construction of electrical machinery will be confined to those fortunate individuals who possess the largest faculty for guessing.

It is stated in the textbooks that magnets have two poles, and that these exist near the ends of the magnet. There is no exception given to the rule.

Let us see what practical experience will demonstrate. First, we find that the poles of an ordinary horseshoe magnet may be shoved around to any point desirable. An ordinary horseshoe magnet has its poles located about as indicated in the sketch, the + mark indicating the south or positive pole and the — mark the north or negative pole. The textbooks do not say that the + pole may be moved around to the point marked A, leaving the former + limb of the magnet entirely neutral or dead, and having two distinct and well developed poles at A and at the end marked —. Again, the textbooks do not tell us that both poles of the permanent magnet may be moved up to points marked — B and + B, leaving the two lower ends neutral. And then, again, they do not mention the fact that both

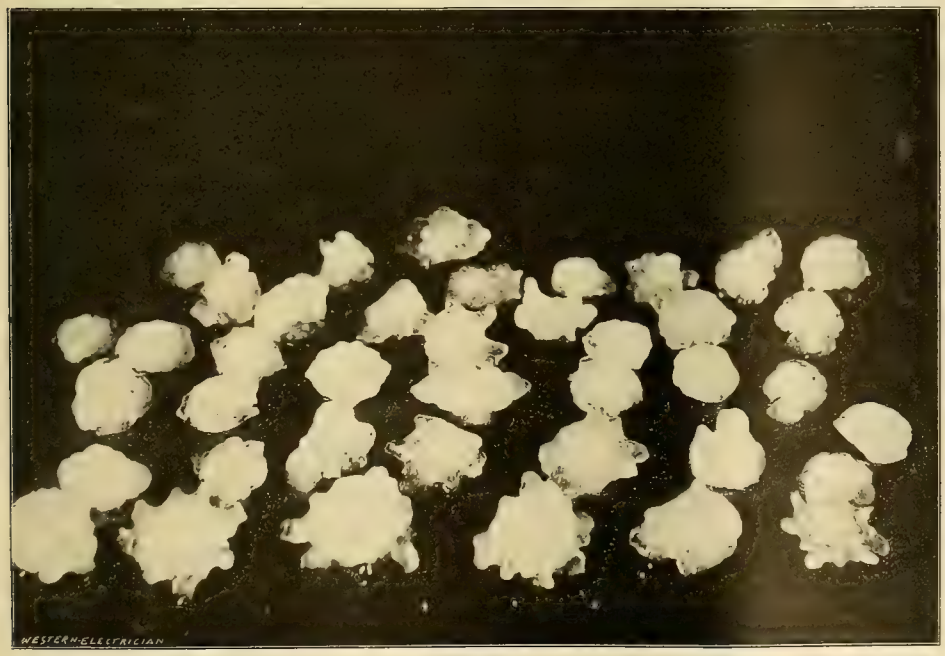


FIG 3. CYCLONE IN NIAGARA REGION.—HAILSTONES (ONE-SIXTH ACTUAL SIZE).

of the poles may be moved down to the extreme ends of the magnet, leaving the limbs above almost entirely neutral. Yet these strange transitions of the poles of a steel magnet can be made without injuring the structure of the magnet or without the use of electricity as an aid.

I will not burden this article with an explanation of how it may be done. The method may be known to others. It was an individual discovery, however, and is interesting, if new.

In the second place, the textbooks do not give a limit to the length of a magnet, permanent or electric. Yet there is a limit; that is, there is a limit to the length of a simple magnet without developing consequent or intermediate poles. I have never been able to make a magnet with only two poles, longer than 39 inches.

Again, we may note that there is a very short limit to the distance to which magnetism may be conducted by an iron bar or rod.

A fourth point is that the strength of a steel magnet is due as much to the manner in which its magnetism is conveyed or contributed to it as to the quality of the material of which the magnet is composed.

One of the methods given in the textbooks for magnetizing a piece of steel is "by contact or by touch;" that is to say, a piece of steel to be magnetized, is to be brought into contact with the poles of a permanent or electromagnet, and "touched" several times. While the piece of steel is in actual contact it is magnetized by conduction; as it is being taken away and has left contact it is demagnetized by induction. Therefore the magnetism retained by the piece of steel is the resultant or difference in the contact effect and the inductive effect. In other words, if the contact effect be equal to 10 and the inductive effect, which is an opposite effect, be equal to 5, then the piece of steel will retain magnetism equal to 5.

Now if this piece of steel were to be placed in a solenoid and rapidly withdrawn, the result would be the same as above, for the reason that just as the end of the steel passes the magnetic meridian the solenoid would exert an influence on the receding steel opposite to that which it effected when the receding end was on the other side of the meridian. If the steel is placed in the solenoid and left undisturbed and the circuit closed and opened, the result would be unchanged from that noted above, for the surging of the current, producing self-induction, would produce a counter effect on the piece of steel, tending to demagnetize it.

Yet the steel may be magnetized to its maximum capacity without any of these demagnetizing effects.

Once more: the retention of the core of an electromagnet may be varied to almost any extent. A very long, thin pair of electromagnets, when the coils are connected in series and when the coils are surrounded with a closed circuit, such as a copper cylinder, are very sluggish in action, the cores retaining magnetism for a very perceptible time after the circuit is broken. The same magnets, wound in short, thick coils on a relatively short core, will produce quicker magnetic response. The same coils connected in parallel with equal ampere-feet will produce a magnet which will act more quickly than either of the former; and now if the yoke be removed from the latter magnet the magnetic response will be instantaneous.

There is much that can be learned by a careful observer in the everyday practical application of these forces, and sometimes one learns that which is already known to others. If I have done this I simply plead good intentions in my attempt to interest the readers of the Western Electrician.

Brussels' Electric Railways.

The citizens of the Belgian capital, according to l'Energie Electrique, are in high glee over the fact that they have an electric road which has neither post, pole nor trolley.

The street-railway lines of Brussels, like those in American cities, are the result of gradual development. The first electrically operated routes, of course, were of the overhead trolley variety, and these to-day comprise 17,570 meters of double track, while 10,400 meters of the conduit-trolley type have been added lately.

The main artery passes longitudinally through the city, from the Depot Bois to the Depot Schaerbeck, with short branches, the longest running to the park.

The older plant comprises five Babcock & Wilcox boilers, each having 235 square meters of heating surface. The chimney of this battery is 34 meters high and two meters in diameter at the summit.

Five compound tandem MacIntosh & Seymour engines of 120 horse power at 235 revolutions are belted to an equal number of four-pole Brown dynamos of 100 kilowatts each, delivering 200 amperes at 500 volts. So far the installation is known as the old system. The new equipment comprises two Corliss-Bonjour compound-tandem engines of 500 and 1,000 horse power. These machines are direct-connected to two eight-pole General Electric dynamos of 400 kilowatts.

The switchboard is of American pattern, and is made up of 17 panels, nine of which correspond to the nine engines; one is occupied by meters and seven are for the feeders. Each of the nine machines may be connected to either the aerial or the underground systems, at will. These two systems are of necessity independent, for while one has a metallic circuit, the other uses the rail for a return conductor.

The connections between machines and feeders are made thus: All the + and the compensation wires of the dynamos end at two bipolar switches, each on its individual machine. A series of these switches is brought to a general + cable on one side, and from the other to a general compensation cable for the aerial system. Similar connections are made for the subterranean system. This last ends at the feeder switchboard of this system, and the corresponding positive ends at the aerial feeder switchboard. In both cases the meter circuits are included. The negative lines are brought separately to a third panel, which is simply occupied by the necessary dynamo auxiliaries. The negative cable of each dynamo passes through an ammeter, an automatic switch, and is then brought to a throw-over switch, one side of which goes to the earth from the overhead system, while the other side leads to the negative bus-bar of the subterranean feeder system.

Each panel of the dynamos is equipped with a voltmeter, an ammeter, an automatic switch, a main switch, a lamp switch, an exciter-circuit switch and a field switch, and each feeder panel has a principal switch, an ammeter, a fusible cut-out and an automatic protecting switch.

The feeders for the underground system have the main switch arranged to enable a quick reversal of polarity. Each feeder of the underground system has a single-pole automatic breaker on one side only. This is arranged so that a short-circuit will open and cut off only a single line, leaving the rest of the system unharmed. The compensation balance is at once changed automatically, and the affected portion of the system is then held off until the proper repairs are made, when the compensation automatically restores the normal voltage.

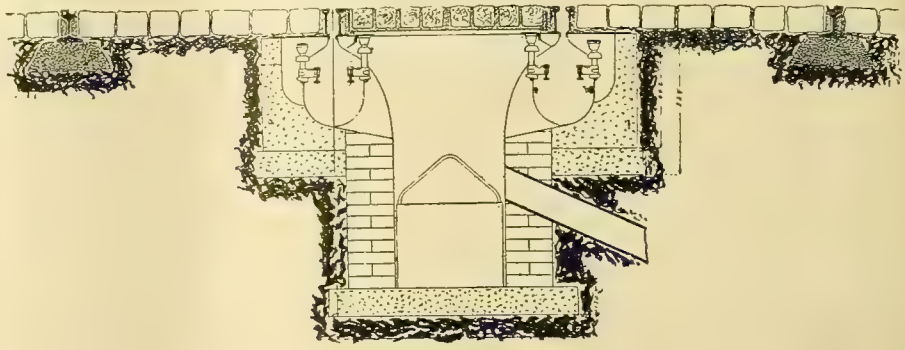


FIG. 1. BRUSSELS' ELECTRIC RAILWAYS CROSS SECTION OF LINE, SHOWING CONSTRUCTION OF CONDUIT AND SYSTEM OF DRAINAGE FOR UNDERGROUND TROLLEY.

A plan of introducing a liquid resistance at any time, for the purpose of burning off an interruption caused by grounding, is one of the features of the system.

The trolley wire is divided into sections of about 500 meters, connected by feeder wires which are brought up through the interior of the posts. Circuit switches are placed to enable the cutting off of any section when necessary.

The track rails are supported by chairs of cast-iron placed on a foundation of beton, of a minimum thickness of 16 centimeters, but thicker where the nature of the earth demands. These chairs or rail seats are capable of resisting a pressure of 20 tons, exerted at 25 millimeters away from the joint. Tests of this nature failed to discover the least failure of the line. The chairs are covered with asbestos soaked in boiled oil, and this is supplemented by a coating of Chatterton, by way of still further increasing the insulation through the conduits.

The general construction of the underground work is shown in the sectional view. A very delicate and difficult point in the matter of insulators was to find the proper material with which to surround the metal required for strength, the expansion and contraction of which is liable to produce cracks, impossible of detection by the naked eye, yet sufficient to produce serious leaks and consequent waste of current. At Brussels the insulators are made of a combination of soft iron and hard gutta-percha—the latter being pressed on with great force, while the material is hot and soft. The mass is then turned down to the proper shape and dimensions, and polished. They are then tested in the following manner:

The naked metal of the insulator is connected with one of the secondary poles of a Rhumkorff coil of 5,000 volts capacity. Upon the opposite extremity of the insulator a damp sponges is placed, and this is connected to the other pole. The least defect in the insulation is shown by a shower of sparks.

These lines have now been in operation for nearly a year, and have proved themselves excellent examples of the much-maligned underground electric roads. Rain, snow and storms of all kinds have failed to disarrange or to seriously interfere with their success.

A combination of trolley and underground systems permits the motor cars to be used on either surface or subterranean lines, as occasion requires.

To prevent accidents, in case the motorman neglects to raise his "plow" at the end of the line, an inclined plane, automatically raises it for him before the terminal wall is reached.

The people of Brussels are congratulating themselves, and taunting the Parisians over the fact that the terrible menace to Americans, "complet," which flops down at the rear of every omnibus, when the seats are all taken, and compels a wait for the next vehicle, will soon become a thing of the past, for the electric cars, more roomy, more rapid and more frequent, will permit all to ride and still leave room for one more.

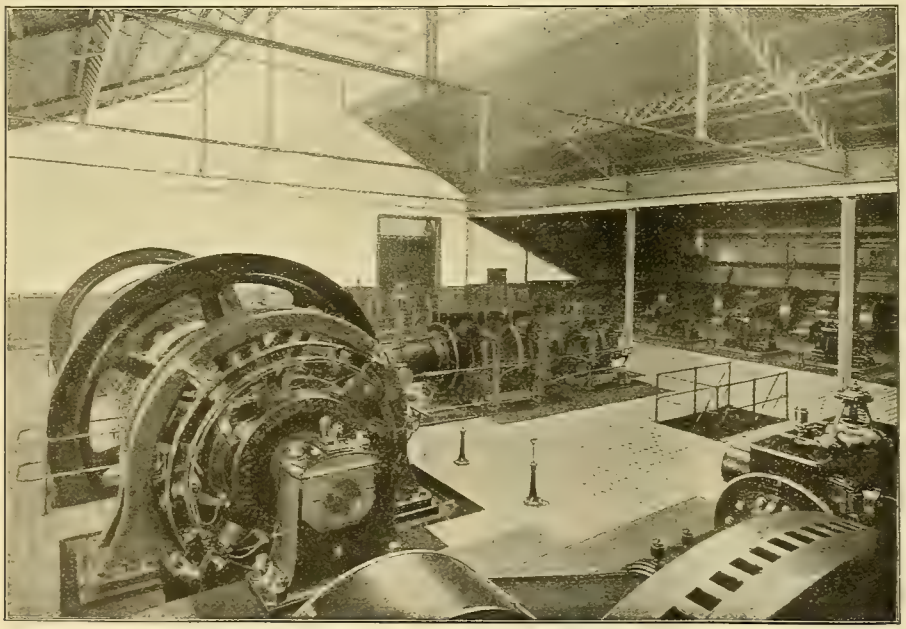


FIG. 2. BRUSSELS' ELECTRIC RAILWAYS.—DYNAMO ROOM.

Electric Cab Service in Chicago.

A sample electric cab, expected to be the forerunner of an extensive cab service, is now seen on the streets of Chicago. It is a regulation hansom, with a seat for the driver, or operator, in the rear, and another for two passengers in front.

Power is obtained from 44 cells of storage battery under the driver's seat. There are two 90-volt 2½ horse power motors on the rear axle, the pinion of each engaging with a driving gear on each wheel. The motors are iron-clad but not boxed in. A steering handle is connected with the front pair of wheels and effectual braking apparatus is provided. The cab carries side lights, and as it is handsomely finished and upholstered it presents a fine appearance.

An electric cabriolet will also be tested next week. The driver's seat in this cab is in front, and the battery cells are divided, part under the driver's seat and the remainder under the passengers' seat. This vehicle is receiving the finishing touches at the factory of the Fischer Equipment company, where the hansom was also built. The vehicles are guaranteed to run 40 miles on one charging and are geared to a maximum speed of 10 miles an hour. They have solid rubber tires. The charging station is at No. 110 Twentieth street, where current is taken from the Edison circuits, but if the experiment is successful the cab owners will at once order 24 additional cabs of each type and maintain a plant near the business center of the city.

Man Killed by 500-volt Current.

It has been generally held that an electromotive force of 500 volts is not high enough to force sufficient current through the resistance of the human body to kill a man. A few cases of death from 500-volt shock have been reported, but the attendant circumstances were usually such that doubts remained whether electricity was the sole cause of death, especially as there is a large number of well-authenticated cases where men have taken currents of much higher voltages, even up to 2,000 volts, with but temporary ill effects. The nature and length of the contact, the direction of the path of the current through the body and the general vitality of the subject have so much to do with the fatality of electric shock that the circumstances of each case must be carefully examined before it can be fairly compared with any other. Such examination has shown that deaths solely due to 500-volt currents of electricity are extremely rare. However, one occurred last week in Chicago, about which there seems to be no doubt.

Frank Masterson, 33 years old and unmarried, a lineman of the Chicago Telephone company, was at work on the forenoon of September 29th on Western avenue near Jackson boulevard. He was on a pole engaged in taking down a number of telephone and fire-alarm wires which were to be placed underground. An overhead-trolley railway runs through Western avenue at this point. The trolley wires are protected by guard wires, and, through some carelessness, one of the guy wires at the corner, supporting a guard wire, had become slackened just enough to permit a passing trolley with an unusually strong spring to force the trolley wire high enough to make contact with the guy wire. Not every passing car forced the trolley wire high enough to make the contact; the accidental connection was only made occasionally. But it happened that Masterson, standing on one cross-arm and leaning out over another, was manipulating the wires with both hands just at the time a passing car shoved the trolley wire up to the guy wire, with which the telephone wires were then in contact in the lowering process. The unfortunate man made no outcry when the current passed through his body, but he was dead when taken down a few minutes later by some passers-by who noticed the limp body. He was not badly burned. The contact could only have been of slight duration, during the instant the wire was pressed upward by the passing car, but the current passed directly through the body by the arms. Masterson had no reason to suspect the defective guy wire and appears not to have provided himself with insulating gloves or other protection. Mr. E. B. Ellicott, the city electrician, investigated the case and came to the conclusion that the man was undoubtedly killed by the escaping current from the street-railway circuit.

FIG. 3. BRUSSELS' ELECTRIC RAILWAYS.—ARRANGEMENT OF ENGINE ROOM.

The World's Platinum Supply.

Inasmuch as Russia supplies practically all the platinum used in the world, the movement now under way in that country to secure for the platinum miners a better price for their product is one which may well excite the close attention of the large number of manufacturers in the electrical industries to whom the use of platinum is a necessity. One would think, from the high price of and steady demand for this metal, that the lot of the platinum miner would be an enviable one; but such, it appears, is not the case. The platinum trade of the world is really controlled, not by the Russian miners, but by a few British and German dealers, who, both in buying and selling, are alleged to fix their own prices. Thus both the producer and the consumer suffer; the middleman gets a very large profit. It is stated that the traders buy the greater part of the platinum in the Ural region at a price of $99.82 a pound; the higher price paid for a smaller portion does not exceed $130 a pound. The prevailing price to-day for the metal in London is from $226 to $230 a pound, and in New York from $230 to $250 a pound. The difference is thought to represent more than transportation charges and a fair profit. The miners claim that they are helpless in the hands of the foreign dealers, and they have appealed to the Russian government for assistance, which has been promised. The government agrees to extend the necessary credit to the miners and to sanction and help their movement. This is an important decision. Whether it will enhance the price of platinum or merely destroy the power of the middlemen remains to be seen. At any rate, there is no reason to hope that the American manufacturer will get his platinum any cheaper.

The situation is set forth in detail in the Torgovo Promishlennaia Gazeta (Gazette for Trade and Manufactures) of August 23d, in an article signed by N. P. Steinfeldt of Ekaterinburg, a city on the eastern side of the Ural Mountain range, in Asiatic Russia. This article has been translated for the Western Electrician, and is given herewith. It may be noted that a pood is a weight equivalent to 36.113 pounds avoirdupois and that a ruble is valued at 51½ cents in American currency.

Russia, producing more than 94 per cent. of all the platinum mined on the globe, should have a monopoly of this mining industry. One would think that such an exceptionally favorable position should yield great advantages to the small group of platinum miners of the Ural, which is the only place where platinum is found in a considerable quantity. In reality the situation is entirely different; the monopoly is in the hands of a few foreign firms with offices in London and Hamburg and agents in Russia, who buy up all the crude platinum of the Ural at their own prices (on the average up to 400 poods, for the sum of 3,500,000 rubles) and then put it on the market in the form of manufactures, acquiring profits from 60 to 300 per cent. on the invested capital.

At present the price for crude platinum is from 9,000 to 10,000 rubles a pood, while manufactures of it are sold at from 16,000 to 24,000 rubles a pood. In Russia there is almost no manufacturing of paltinum, and therefore all the difference in the price between the crude platinum and its manufactures goes entirely to the dealer. The reafor the existing order of things in this industry may be found by a glance at its history.

Only nine years ago the standard price for platinum was so low that its mining could be done only in a primitive manner, as it did not pay to apply any improvements. The mining was only possible from the fact that the Ural platinum is so deposited that to secure it does not require any special technical appliances, large investment of capital or skilled labor. Therefore platinum was mined only by people of small means, who were satisfied with small profits. None of the miners had much capital, and the whole transaction was done entirely on credit and in a simple and primitive manner.

At this time the foreign demand for this precious metal began to increase; the price went up, and people commenced to look upon platinum with interest. This was precisely the time when the foreign firms began their work. The representatives of these firms took advantage of the unfortunate position of the platinum miners and advanced them the needed capital, with the stipulation that the miners should sell to them exclusively their entire output of the metal for a number of years. When this one-sided contract was agreed upon platinum was quoted at 7,000 rubles a pood. At present the price is, say, 9,000 rubles, but the platinum miner, who is still under the obligation recited (it has five or six years to run), receives from the foreign contractor only the 7,000 rubles, and must pay the interest on the borrowed money beside. Thus the foreign purchaser has all the benefit from the advance in the price.

There is no chance for the platinum miner who was compelled to contract under such conditions to escape his serfdom. Seven thousand rubles will ordinarily cover the mining expenses, leaving a small profit, but often the result is not so favorable, and the miner is compelled to put himself under new obligations. Under such circumstances, all real progress in the platinum-mining industry is precluded. These circumstances make it impossible for the platinum miner to think of erecting a plant for the manufacture of the metal or even to stop mining with the idea of securing better prices. It is the picture of a squirrel in a cage.

Most of the platinum miners of the Ural are suffering from this state of affairs. The few lucky ones, who have managed to escape the nets of the foreign contractors, have not become strong enough to fight successfully the rich foreign firms. In general, the state of the platinum-mining industry is as if it were started only yesterday.

A careful consideration of these facts has led the Gold and Platinum Miners' Assembly of the Ural to apply to the government for assistance in the endeavor to improve the miners' situation and to free them from the fatal burdens enumerated. For this purpose, the erection of a government factory for refining and manufacturing and the extension of credit by the government were proposed. Not long ago these propositions were taken into consideration by a special government commission at the Department for Mining, which is in charge of the Ministry of Finance. The commission rejected the first proposition—that for the erection of a factory by the government—arguing that such an undertaking would involve rather large expense upon the Treasury, while there was no guarantee that such a factory would be a success. Concerning the question of establishing credit and financial assistance for the platinum miners, the Department for Mining expressed its full concurrence in the project of organizing a syndicate of the platinum miners, under the auspices and assistance of the government. It promised to encourage the movement by granting the necessary credit and other help which would be necessary to success.

For the purpose of working out a definite plan for the organization of a syndicate of platinum miners of the Ural, a joint commission of representatives of the Platinum Miners' Assembly, the Ministry of Finance and the Ministry of Agriculture will meet in St. Petersburg. The news of this decision of the Department for Mining caused great enthusiasm in the Ural.

English Electrical Engineer.

The other day we happened to be on board ship with a number of well-known engineers as well as a general cargo of passengers. One of the general cargo let everyone around him know that he was an electrical engineer. We have in our time met many electrical engineers, but had never previously seen, to our knowledge, this particular specimen, nor do we ever wish to see him again. Some of the engineers aboard were closely connected with electrical undertakings, and naturally questions were asked—and answered by the specimen. Now, practical men always harp on the question of cost, so it was news to some of us to hear the specimen emphatically assert and reiterate again and again that the total cost of generation per unit could not be much less than 6d. Under exceptional circumstances it might be reduced to 4d. The moral is this—do not talk with strangers on subjects you know very little about. As one gentleman remarked, "I knew a good deal more than he imagined, and so could not believe anything he said." The best of it was the specimen quoted chapter and verse for his statements, and the singularity of his proofs was that they always concerned installations by "Lord This" and "Sir Somebody" that.—London Electrical Engineer.

Western Electrician.

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Gradually the electrical wires of Chicago are going underground, not only in the central business district, where the rule has been enforced for several years, but in the outlying districts as well. The mayor has lately decided that whenever a street is improved by a high-grade pavement designed to be permanent for a long term of years, as asphalt, for instance, all the electrical wires along the street, in the district so paved, must first be placed in underground conduits, so that the pavement need not be disturbed for that purpose at a later date. This regulation is made to do justice to the efforts of the taxpayers to improve and beautify the city, and the electrical corporations will doubtless cheerfully comply with it, as it enables them to perform a task that lies inevitably before them by easy stages, as street improvements progress. The new rule applies to all parts of the city.

Riding on platforms of electric cars has proven a prolific source of litigation, and conflicting decisions have been handed down. The last pronouncement is by the Supreme Judicial Court of Maine in the case of Watson against the Portland and Cape Elizabeth Railway company. The court holds that it cannot be said, as a matter of law, that a person who sustains injury while riding upon the platform of an electric car is, merely from that fact, guilty of contributory negligence which will prevent his recovery of damages in an action against the carrier; but a passenger who rides on the platform of a car, the court adds, necessarily takes upon himself the duty of looking out for and protecting himself against the usual and obvious perils attendant upon his position, such as, for instance, the danger of being thrown from the platform by the jolting or swaying of the car. The New York courts have held, on the other hand, that when a railway company accepts fare from a passenger riding on the steps of a car, it must protect him, and that the company is liable for any injury he may sustain through the jolting of the car or turning of curves. In one case, where the platform was covered with ice, it was shown that the conductor had warned the passenger of the danger, but the court held that this did not relieve the corporation of liability.

That electric-railway manager who stints his passengers in the use of current for lighting in the afternoon or evening is exercising an unwise economy. Especially in the long hauls in the early evening at this time of the year, the conductors or guards should be instructed not to wait until the last possible moment to illuminate the interior of the cars by closing the lighting switch. Whatever the oculists may say about the evil effects of the practice, home-going men, and women, too, continue to read the afternoon papers on the cars. But in some cases the lamps are not promptly lighted as the dusk deepens, and the passenger, straining his eyes at the printed page with increasing discomfort and irritation, finally gives up the attempt to read in despair. He makes a mental note that he will patronize the line as little as possible, and his resentment is not perceptibly abated when the light is turned on 15 or 20 minutes—perhaps half an hour even—after it should have been.

Then, too, aside from the question of reading, a brilliantly lighted interior adds greatly to the cheerfulness and attractiveness of a car and serves as a most effective advertisement along the line. The fault is not so noticeable, perhaps, on the surface cars—speaking of Chicago particularly—as on some of the elevated electric railways. There is no doubt that the slight extra expenditure of money and effort necessary to insure well and promptly lighted cars will pay for itself many times over.

An attempt has been made by the promoters of acetylene projects to revive interest in the subject, and one of the plans adopted provides for the illumination of the streets of a small Indiana town. The nature of this undertaking was explained in the last issue of the Western Electrician. This and similar efforts elsewhere have led a subscriber at Deadwood, S. D., to ask for information upon the present development of apparatus employed in the manufacture, use and regulation of acetylene gas. Like many other owners of small electric-lighting properties, he is apprehensive that the new illuminant may seriously affect the value of his plant. For his information and for the enlightenment of others similarly situated, it may be said that there is no apparent danger to the electric-lighting industry of the country from acetylene. At the present time the patent situation is hoplessly involved, and there is no immediate prospect of settlement. Another condition that confronts promoters of acetylene projects is the method that has been employed in financing the scheme. The "parent company" has made wise provision against the future; territorial rights have been disposed of at fabulous prices, and the local companies have been saddled with a financial burden at the outset far beyond their ability. Practically nothing has been done toward developing and perfecting the apparatus employed, and frequent explosions have demonstrated the unreliability of the means of regulation now used.

In view of the numerous accidents, involving loss of life and destruction of property, an investigation of the subject was instituted some time ago, and so grave were the conditions disclosed by this examination that the National Board of Fire Underwriters engaged Professor Henry Morton of the Stevens Institute of Technology to conduct experiments on the subject along scientific lines. This examination has been completed and the result has been embodied in the rules adopted by the National Board governing the use of acetylene. The restrictions imposed by the new rules are quite severe, as compared with the former methods, but they are not burdensome. Danger attending the presence of acetylene is recognized and provided for by directing that "the generating and gas-holding apparatus, when installed for lighting buildings in the closely built-up portions of towns and cities, must be situated in an outside, fireproof and well-ventilated building." Another important provision is that "no artificial light shall be used inside of the building in which the gas is generated, and no heat except steam." It is also declared that "the storage of liquid acetylene in any building, or the use of liquid acetylene gas, should be absolutely prohibited." Heretofore the claim has been made that an installation of this kind did not require the services of trained attendants, but the National Board declares that "all generating apparatus should be in charge of persons properly instructed in their management."

The form and material adopted for generators and gas-holders are carefully considered, and stringent rules governing these features will be enforced. Aside from the question of fire risk the report suggests many restrictions in the interest of safety. It points out that "bicycle and other portable lamps, in which acetylene gas is generated and supplied direct to burners, should not be approved until such lamps are so constructed that they will cease to generate gas immediately upon the extinguishment of the flame."

The result of this investigation and the strict enforcement of the rules of the insurance interests cannot fail to exert a beneficial influence, as they will effectually restrain any tendency to introduce and use acetylene in a reckless manner. If the promoters of acetylene enterprises will show a disposition to co-operate with the National Board of Fire Underwriters they will do much toward restoring public confidence, and while the development may be more conservative the growth will certainly be more substantial. There is an excellent field for all forms of artificial illumination that combine the essential features of efficiency, economy, safety and reliability. At present acetylene is deficient, and the serious objections against it must be overcome before it can be introduced into general use.

A short but very important electric railway has been completed between Waterloo and the city of London. At the formal opening of this road the Duke of Cambridge made the trip from Waterloo to the city and return in 10 minutes, and in commenting upon this achievement he recalled the fact that 60 years ago he was present at the opening of London bridge by King William IV. When the procession crossed the river in the state barges on that occasion the possibility of the present enterprise was not dreamed of; in fact, if anyone had intimated that in 60 years he would be able to cross beneath the water the world would have considered the prophet a fit candidate for a lunatic asylum. The new line connects the Waterloo terminus of the Southwestern railway with the Mansion House and Bank of England, and will eventually terminate at the London Central railway. The total length of the line is three kilometers. Trains run every five minutes, and the trip requires only five minutes. There are two steel Greathead tunnels, but a departure has been made in the method of applying power. There are no locomotives. The trains consist of four carriages, and each carriage has a motor, making four motors on every train. The maximum speed is 38 kilometers per hour.

Each train has a capacity for 200 passengers. Assuming that there is an average of half that number during 18 hours a day, with a five-minute trip, the total number of passengers would be in the neighborhood of 16,000,000. The earning capacity of the road under these conditions would be $500,000 a day.

Electrical Industry in India.

In the case of the electric telegraph in India the interests of the government are intimately bound up with those of the general public, and the former has the entire control of the department. A large staff of specialists trained for the purpose is maintained by the government, which has brought the department into a high state of proficiency. The difficulties the department has to contend with in laying down lines through forest and jungle are very great in some instances, while constant watchfulness is necessary for maintenance as, for example, in the telegraph line from Srinagar, in Cashmere, to Gilgit, owing to changes in temperature and other causes of a local nature.

There can now be no doubt of the popularity of the telephone in India, although it is at present confined to the larger cities, and is intended for local convenience only. More recently, however, experiments have been made, so that the limits of a single city have been exceeded, and a long line of telephone has latterly been experimented with between Calcutta and Nagpore. Some further long-distance experiments have also been performed between Colombo and Trincomalee, a distance of 220 miles, and the preliminary trials have been so far so successful that it is hoped the project will assume a practical shape. The use of the telephone has so far been confined to the conveyance of mercantile and domestic messages and for police and fire-brigade use.

The electric transmission of power has not hitherto found a suitable application in India. The existing arrangements can be regarded as no more than toy installations, such as that of the Maneckjee Petit Manufacturing company's cotton mills, Bombay, where a dynamo furnishes current to two motors in parallel, at a distance of about 200 and 400 feet, respectively. The latter operate the feed parts of all the exhaust openers and the hoist for cotton bales in the mills.

Much better progress is noticeable in the section of electric lighting, and installations exist all over the country, without being confined, as in the case of the telephone, to the principal cities only. Both arc and incandescent lamps are used, while the Jablochkoff candles find a limited application, as in the Reay Paper Mills at Pootna. The latter, on account of their great simplicity, deserve to be more largely employed in Idia, and the result of the trials so far is very encouraging. The more complicated mechanism of arc lamps and the great difficulty of repairing or replacing them or their parts render this class of lamps less suitable for present use in India. Installations of all sizes exist, although the largest of these cannot be said to be worth more than 50,000 rupees (about $12,000). Another installation, which may be regarded as one of the smallest, consists of a few incandescent lamps used in a cotton mill in the Bombay Presidency during the day time for an insufficiently lighted room. An inverse ratio may be said to exist between the use of the telephone and the electric light between country towns and cities. Some of the largest of the installation of light exist in the former in the palaces of native chiefs and their surroundings. In the Bengal Presidency the native nobility has hitherto patronized the electric light more than the wealthy European firms, the railway companies, and the like, of whom there are not a few in that part of the country. There is not a single European residence in Calcutta furnished with the electric light. It is surprising, taking into consideration the advance in commercial enterprise, characteristic of the Presidency towns, the large number of majestic buildings, etc., how few installations exist in these places. They are decidedly behind the times.

There is a sufficiently large number of electrical engineers in India, mostly located in Bombay, Calcutta and Madras, to do all the work that is to be had. The principal European firms have established agencies in India, and their number is increasing. In Calcutta and Bombay the firms of Crompton & Co., Siemens Bros. & Co., the India-rubber, Guttapercha and Telegraph Works company, Lang, Wharton, Downs & Co., the Oriental Telephone company, Mavor & Coulson, etc., are represented by agents. In Bombay, Messrs. Nowrosjee Wadia & Sons hold the agency of Messrs. J. H. Hall & Co. of Oldham, and of the Electric Storage company, London. The Silvertown India-rubber, Gutt:apercha and Telegraph Works company and several other English and continental electrical firms are also locally represented. H. C. G.

Cheaper Telephone Service.

[From the Chicago Record.]

The letter of Mr. James Langland, written from Christiania, Norway, published in the Record of Saturday, serves to call attention to an abuse that ought to be the subject of extensive and persistent agitation in this country. Street-railway and lighting corporations are coming to be objects of close public scrutiny, but telephone companies, that are even more exorbitant in their charges, are allowed to proceed in their course without much opposition. Public attention has not yet been strongly directed toward them. When it is there must be such reforms as will make the telephone of far greater use to the community by placing it within reach of a much larger proportion of the people.

Concerning the telephone system in Christiania Mr. Langland writes:

"One thing which invariably attracts the attention of the casual visitor to this city is the widespread use of the telephone system. Everybody telephones. It is the one means of communication which is universally employed. One does not have to go far to find the reason; it is simply that the system here is as cheap as it is perfect. The rental of a telephone is only $20 a year, instead of the almost prohibitive sum charged in most of the cities of the United States. There are booths in the streets where there are public telephones which may be used for 2½ cents. The government has charge of the telephone lines, and, of course, does not seek to make a profit out of them, hence the cheapness of the service. Its excellence is due to the same cause. The employes at the "central" are prompt, obliging and courteous, and consequently are not the propagators of profanity, as is the case with some of their confreres in other parts of the world. Long-distance telephones unite the capital with most of the other cities in Norway, and the system is being extended in all directions. This service is also cheap and effective."

The charge for telephone service in Chicago is $125 a year for business places and $100 for residences. On this basis there is an enormous profit in operating a telephone system. The charge could be reduced very much and still leave a reasonable profit. The telephone is one of the instruments of civilization that ought to be placed at the service of the people just as much as possible, and no community is thoroughly progressive in which those in control of this means of communication are allowed to restrict its use, to the detriment of the public, by keeping the price for service so unnecessarily high that only the few can afford telephones.

Efforts have been made in many American municipalities, generally the smaller ones, to combat the evil of high telephone charges. Detroit is one of the few larger cities in which this has been attempted. There an independent exchange was organized, while Pingree was mayor, in opposition to the regular company. This move resulted in giving the people much cheaper service. Many Michigan cities have independent exchanges, which have been connected so as to give a long-distance service similar to that furnished by the Bell company. This attempt to secure a cheaper service through competition has its disadvantages, however, for it results in giving a city two telephone systems instead of one, which is a source of vexation and inconvenience, because some citizens will use one exchange and some the other. The telephone business ought to be a monopoly, not only for a particular city, but for the entire country. That might as well be admitted at once and competition as a means of bettering conditions eliminated. The telephone business, if entrusted to private corporations, must be strictly controlled by public authorities in the interest of the people, both as to price and quality of service. If that does not produce satisfactory results the telephone business will have to be taken over by the Postoffice Department, as it is in Norway.

It is high time that steps were taken to force a reduction of the enormous telephone charges that prevail in Chicago, as in most other American cities.

How to Make Aluminum Bronze Bearings.

By L. F. Besel.

I will attempt to explain briefly how I secured some bearings with aluminum bronze (12 per cent. alloy). I made a number of castings by "feeding" the metal with a rammer, as shown by Fig. 1. The crown of the model comes in the cope, and I remove the latter when the metal is still soft and set down any uneven places, using a smooth-butt rammer for the purpose. I use sand as dry as possible, and ram firmly, swabbing as lightly as possible, and pour the metal at low heat for journal boxes. If the casting "skins" and bubbles from beneath the film, your sand is damp or your metal not in good condition to flow.

Fig. 2 shows a way to cast sleeves for small bearings. The mold A is made of brass and is airtight.

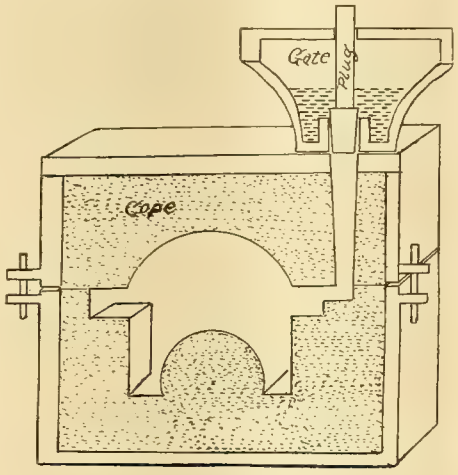


Fig. 1. Feeding the Casting.

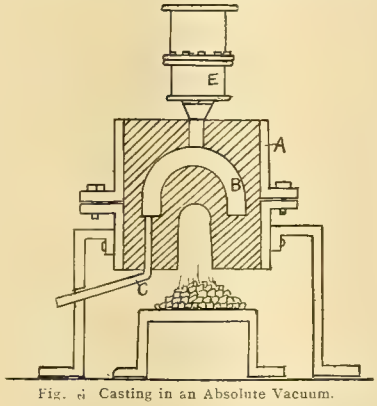


Fig. 2. Casting in an Absolute Vacuum.

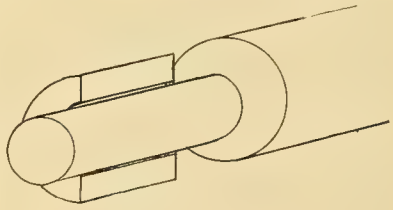


Fig. 3. Shaft and Sleeve.

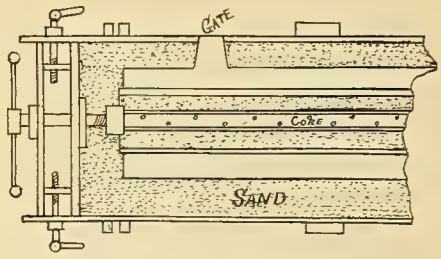


Fig. 4. Casting Aluminum Bronze Shells.

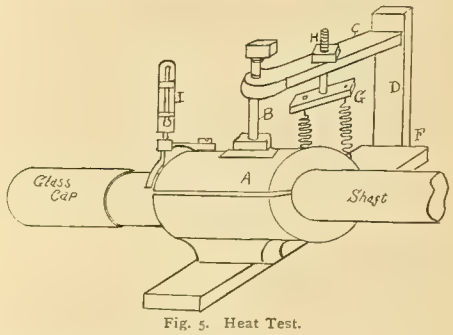


Fig. 5. Heat Test.

HOW TO MAKE ALUMINUM BRONZE BEARINGS.

Metal which melts at low temperature is poured into the mold, completely filling the space B, leaving no air space. The aluminum bronze molten metal is put into the gate E, and the coke fire dissolves the metal in B, permitting it to flow out at C, admitting the metal from E. A check piece stops the flow at the right time, and the aluminum metal is allowed to cool in what is believed to be a perfect vacuum.

Fig. 3 shows the shaft and a half sleeve of a box journal of aluminum. The first experiments with this pattern were with a pair of 10 by 16-inch bearings, with two oil holes on the top center line. They were fitted 1-64 inch diameter larger than the journal, and they ran cool and showed no unusual wear when given the usual pressure and high-speed tests.

In Fig. 4 I show my way of casting aluminum bronze shells. The sand is dry, the core swept with loam, and the metal poured when at low heat.

I fixed up in Fig. 5 a stationary bracket C, D and F, and fitted a pressure screw B to reach the cap A of the box. There being a strong spiral spring clasp at G, the turning down of the nut H would press the cap A on the bearing, causing it to heat. The temperature was recorded by the gauge I. Instead of ascertaining contraction and expansion with calipers, I put snug-fitting glass cylinders on the end of the shaft, as shown. Any enlargement in the size of the shaft would, of course, crack the glass.

Although run at a high speed for several hours without oil, during which the parts heated to 110 degrees Fahrenheit, the glass cylinder was not cracked, showing that the metal had not expanded.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Wisconsin Telephone company at La Crosse, Wis., has made connection with the Union Electric Telephone company, which has heretofore connected with the La Crosse Telephone company. This change is a result of the recent purchase of the Union Electric by the Bell. The independent company claims it still has Minnesota connections via Winona, and is arranging for a large number of additional points.

Work is progressing on the new telephone system at Bathgate, N. D., and vicinity.

The long-distance telephone line between Ashland, Wis., and Ironwood, Mich., is completed and in operation.

A telephone line is being strung from Winslow, Ia., to Janesville.

The Hecla company at Glendale, Mont., has just bought and put up 15 new telephones.

The Rocky Mountain Bell Telephone company has completed its line from Butte, Mont., to Dillon.

The Competine Telephone company is building a system to connect Competine, Ia., with Hedrick and Martinsburg.

The Iowa Telephone association, which includes all the independent companies of the state, is up in arms over the policy of the Iowa (Bell) Telephone company in going into all the small towns of the state and urging the council to pass ordinances giving it an exclusive franchise for 25 years and thereafter. The independent companies say these would be practically a perpetual monopoly to the Bell company.

The telephone line between Virginia City, Mont., and Sheridan will be rebuilt soon.

The Dakota Central Telephone company of Aberdeen, S. D., has arranged to connect with Pierre, S. D., and the materials for the line have been ordered.

Pelican Rapids, Minn., now has long-distance telephone connection with the outside world, via Fergus Falls, Minn.

The Mankato Citizens' Telephone company of Mankato, Minn., has entered into traffic arrangements with the Blue Earth Valley Telephone company for its toll-line service. The company starts out with 250 patrons.

The Commercial Telephone company of Tama, Ia., has made a traffic agreement with the Cedar Valley Telephone company, giving connection with 63 exchanges.

C. B. Wilbur will sue the Iowa Telephone company for $11,000 damages for the death of his son on September 13th. Papers are being drawn at Shenandoah, Ia.

The Central Telephone company has extended its line into Mingo, Ia.

The new telephone line from Dubuque, Ia., to Peosta is in operation.

The annual meeting of the Chippewa Falls (Wis.) Telephone company showed in the neighborhood of 200 instruments in use and a growing business.

Moody & Kerlin will soon have a telephone connection between Menahga, Minn., via Hubbard, to Park Rapids and Latona.

The Standard Telephone company is preparing to enter Caledonia, Minn.

The Western Telephone company has extended its lines to Marshall, Minn.

The Western Electric Telephone company had made all arrangements to extend a line from Albert Lea, Minn., to Geneva and Twin Lakes, but the recent sale of the company to the Northwestern Telephone Exchange company may delay matters.

There is talk at Brown's Valley, Minn., of forming a stock company to build a line to Wheaton, Minn. Connection between the two towns is now made over two systems, but the attempt to utilize the service is so exasperating that a through line is proposed.

The North Dakota Telephone and Electric company of Harvey, N. D., proposes a line to connect with Carrington, Fessenden and Rockford.

Timing Telephone Messages.

In the London trunk-telephone exchange at St. Martin's-le-Grand a large clock, in view of all the operators, is used for timing the messages. It is provided with a large hand, which moves a quarter of a minute at a time, and the operator notes the time of commencement of the conversation as a quarter-minute later than the dial reading, so that the public has the advantage of all fractions of a quarter-minute. It is said that clocks are used at other places in England for similar service and in most of the continental exchanges. In the exchange at Berne there is a very primitive but sufficiently accurate timer in use, namely, the sand-glass. Two sand-glasses are provided for each trunk wire, and are fixed in the corresponding position on the switchboard. The second glass is necessary in case the conversation has not lasted exactly the specified time, in which event the operator need not wait for the sand in the first glass to flow out before giving the trunk line to a new applicant. The London Electrician believes that such a system, with a shutter added to prevent the wrong glass being read, would be as cheap as clocks and more reliable, and quite as useful as any of the more expensive methods.

Telephone Service in England.

Public men in England recognize the importance of the question of providing telephone service of a much more efficient character than that now enjoyed and the necessity of reducing the cost to the subscribers. There seems to be a general disposition to place this branch of the public service under the direct supervision of the Postoffice, after the manner of the telegraph system; in fact, it has always been considered a part of that system by the British Postoffice authorities. The history of the development of the telephone system and the financial questions involved is carefully reviewed in the appended article from the London Statist:

"The telephone problem is one of great difficulty. Nor does the report recently made by the Select Committee of the House of Commons materially assist its solution. Broadly, the position is this: The government in 1868 acquired the telegraphs by paying for them a very large sum of money. Some 10 years later a new form of electric communication was discovered, the development of which threatened to render valueless the telegraph system of the government, for which it paid so dearly. By a technicality of the law, the government in 1881 succeeded in establishing that its telegraph monopoly included telephones, and that its monopoly was thus infringed. The telephone companies thereupon agreed to work under license from the Postoffice, paying to the latter 10 per cent. of their gross earnings as compensation for any loss to the telegraph revenue. In 1884 all the companies amalgamated into the National Telephone, which received a license to work for 27 years—till 1911—and which possessed practically the whole of the telephone patents. The latter expired in 1891.

"In 1892 the National Telephone company sold its trunk lines to the Postoffice under certain conditions. The company is not bound to sell its undertaking to the government at any price other than that mutually agreed upon, or by arbitration. Nor is the government obliged to buy the company's system, even in 1911, if it can do without it. But inasmuch as the whole of the telephones, apart from the trunk lines, are owned by the company, and the Postoffice is obliged, under its agreement, to keep the trunk lines at the service of the telephone company, the position in 1911 will be that, unless the government has an alternative system in operation, it will be compelled either to purchase the company's undertaking at any price which may be asked, or to renew the license.

"That the telephone has not been made more popular and cheaper is largely due to the opposition, in the early days of the telephone, of the Postoffice to the multiplication of call offices, and the making of small charges for single messages, owing to its anxiety lest the new invention should supersede the telegraph, and thus render valueless the telegraph system, for which so much had been paid. Latterly the opposition of the Postoffice has been less pronounced; but the development of the system has been retarded by the difficulty of the company in obtaining wayleaves and by the opposition of the local authorities to a private company laying underground wires. No one will doubt that, had the telephones been permitted to compete with the telegraphs, their use would have rapidly expanded; the country would now have had a telephone system equal to that of any other country in the world, and every town would have been fully equipped with call offices. Thus, with the telegraphs in the hands of the government, and with the latter to some extent controlling the telephones, it is essential that both systems should be owned by the Postoffice if they are to be of the greatest possible benefit to the public. The Postoffice should, therefore, acquire the telephone system as soon as possible, and thus give to the whole community the full benefit of so great an invention.

"The select committee has apparently been deterred from recommending the immediate purchase of the telephones by the fear that the company would ask too high a price. It has consequently suggested that the local authorities should have power to construct and work telephones under license from the Postoffice in their several districts only until 1911, or that the Postoffice should at once commence an effective competition with the company. So far as we can see, neither of these suggestions is really feasible. The local authorities are not likely to spend a large amount of capital and to take an enormous amount of trouble merely to save the Postoffice from doing so, while the Postoffice would be ill-advised to enter into 'effective competition,' requiring much capital and great labor and skill, until it first determined whether or not the price which the telephone company is willing to take for its property is so exorbitant that, sooner than pay the price asked, the public interest requires an alternative system to be constructed. It should, however, be clearly appreciated that the latter would be no easy matter. The construction of a large number of call offices open to the general public on payment of a small fee would not materially affect the National Telephone company, whose subscribers are likely to prefer to have the sole use of their instruments. Secondly, even if the government constructed exchanges ready for subscribers, and offered to supply the telephone at a very low price in any particular district, the company is likely to reduce its rate to a somewhat greater extent, and there would be no inducement for the subscriber to exchange from one to the other. Further, at present it is possible for any subscriber to the National Telephone company to speak with any other subscriber in any part of the country, or with anyone else, if that individual agrees to be at a specified call office at a certain hour. But in the event of competition, subscribers to the government telephone would be unable to speak to subscribers on the National telephone, and until the subscribers to the government telephone were as numerous as those on the National's the latter system would be the more useful, and the government would be unable to get subscribers. In the interests of the community generally, as well as of the shareholders in the National Telephone company, who have embarked their capital to supply an article of great value to the public, and who are entitled to as much consideration as any other trader, we suggest that the Postoffice should be authorized at once to negotiate for the purchase of the National telephone's undertaking at its present market value, as gauged by the price of the company's securities. Thus the National telephone security holders would obtain the return of their capital, and will not be justified in feeling that their property is to be 'confiscated.' At the same time, the government will purchase on very moderate terms a system producing a large revenue, and which would yield a very handsome profit on the purchase money.

"To show clearly our estimates of the cost to the government of acquiring the undertaking at about the present market price we give our calculations. In the first table we show the nominal amount of the capital (£5,302,000) of the National Telephone company, the dividends and interest paid, the present prices of the securities, and the market value (£5,699,000), together with the difference between the market value and the nominal capital (£397,000):

	Amount.	Dividends.	Shares. Nominal value.	Shares. Present market value.	Market value.
	£		£	£	£
Ordinary	2,422,985	6	5	5¼	2,544,104
First preference, 6%	150,000	6	10	16	240,000
Second preference, 6%	150,000	6	10	16	240,000
Third preference, 5%	1,250,000	5	5	5¼	1,312,500
Debenture stock, 3½%	1,329,471	3½	100	102½	1,362,666
	5,302,456				5,699,270

Market value	£5,699,270
Nominal capital	5,302,456
Excess market value	£ 396,814

"Next we show the company's assets, including capital expediture, stocks, materials and other assets, which in all amount to £6,492,000. This, of course, includes the £1,592,000 paid for good-will and patents of the companies amalgamated into the National telephone.

Capital expenditure	£5,936,636
Stock of materials	296,300
Machinery	6,274
Furniture and fittings	25,053
Debtors for outstanding rentals	138,224
Sundry debtor balances	149,039
Cash in bank	41,009
Total assets	£6,492,535

"Reckoning the capital at its market value as above (£5,699,000), and including the company's liabilities of £514,000 for subscriptions paid in advance, and £353,000 for sundry creditors, the total sum which the government would require to pay for the property is £6,566,000. The sum which would have to be paid by the government is set out below:

Market value of securities as per above	£5,699,270
Proportions of subscriptions and rentals in respect of periods extending beyond June 30, 1898, net	514,075
Sundry credit balances	353,097
Total purchase money required	£6 566,442

"The assets given in the second table include, as we have stated, payment of £1,592,000 for good-will and patents expired, which reduces the net assets, apart from good-will, to the value of £4,900,000. Were £6,566,000 to be paid by the government for the property, it would mean that only £1,665,000 would be paid over and above actual tangible assets. This would, indeed, be the sum paid in commutation of profits from 1898 to 1911. This calculation is as below:

Total assets as above	£6,492,535
Less payments for good-will and patents expired	1,592,000
Net assets, excluding all payments for good-will	£4,900,535
Proposed purchase price	6,566,442
Proposed payment in commutation of profits from 1898 to 1911	£1,665,907

"In 1897-98, after deducting the 10 per cent. royalty, the profits of the company were £369,000. Six and a-half years ago they were only £195,000, there having been an expansion in the period of nearly £175,000. In view of the great progress made by the company during the past few years, and the increasing demand for the telephone, this rate of expansion is likely to be fully maintained. Hence, the average net earnings of the company for the 13 years to December 31, 1911, may increase about £175,000, compared with their present level, which would make the net earnings of the company average £544,000 per annum over the 13 years. As we wish to make this calculation specially clear, we set out below the net earnings of 1897-98, compared with those of 1891, and the annual net earnings of

the 13 years to 1911, gauged by the past rate of expansion:

Net earnings, 1897-98, after deducting 10 per cent. royalty —£95,725 paid to Postoffice	£369,017
Net earnings, 1891	195,017
Increase in 6½ years	£174,960
Net earnings, 1897 98, as above	£369,000
Add increase last 6½ years as basis of probable average increase of next 13 years	175,600
Estimated average annual net earnings 13 years to December 31, 1911	£544,600

"Assuming that the government raised the required £6,566,000 of purchase money at 2½ per cent., the annual interest charge would be only £164,000. The government may, however, require to spend a further three millions of capital on the telephones during the next 13 years, in order to meet the increased demand. The average annual interest charge for the whole of the £9,566,000 would be £239,000, which, deducted from the estimated average net earnings, would give a profit to the government from the purchase of £305,000 per annum. In 13 years this profit would total £3,965,000, and, including compound interest at 2½ per cent., it would be about £4,732,000. These calculations are as follows:

2½ per cent on £6 566,000 of British debt	£ 164,000
2½ on further £3,000,000	75,000
Average annual interest charge	£ 239,000
Annual profit to government	£ 305,000
Probable profit in 13 years	£3,965 000
Compound interest on accumulating profits, approximately	767,000
Total profit in 13 years	£4 732,000

Thus, should the government buy the telephones, and in this way obtain an absolutely free hand to develop them as it thinks best, it would be able to obtain them at their present market value, including the other liabilities of the company, for £6,566,000. Deducting the aggregate profits of the 13 years over and above the interest on the capital of £4,732,000, the actual cost to the government of the existing telephones would be only £1,834,000. Thus:

Purchase price	£6,566,000
Deduct probable profits, 13 years	4,732.000
Actual cost to government in 1911 of existing telephones	£1,834,000

"The advantages of such a course as we have indicated, compared with the recommendation that the Postoffice should enter into keen competition with the telephone company, will be patent to all. Indeed, such an arrangement seems to be the only practical way of solving a most difficult problem."

Telephony Abroad.

The telephone system of Vienna was damaged by fire on September 13th. A telephone wire leading from Vienna to Krakau broke and fell across the trolley wire of an electric railway. This caused a fire in a wooden casing under the roof of the telephone exchange, containing 70 telephone cables, but fortunately it was discovered and extinguished before the flames could spread. Several interurban lines were temporarily interrupted, including those to Budapest.

The Wandsworth and Lee District Boards of Works recently passed resolutions in opposition to the metropolitan telephone service being vested in the London County Council, and urging the Postoffice to acquire the property. Similar resolutions were also passed at the Shoreditch vestry meeting last month.

Consul Roosevelt of Brussels announces the commencement of work on a telephone line between Berlin, Brussels and Paris. When completed the line will be more than 621 miles long and the most important in Europe.

Telephone Patent Discussion Revived.

The Canton Republican club has published a pamphlet upon the record of the Hon. William E. Simonds, candidate for United States senator from Connecticut. Mr. Simonds was appointed patent commissioner by President Harrison on July 1, 1891, and, while occupying that position, passed upon two cases of great importance to the community generally and the telephone interests particularly. Upon this part of his official record the political sponsors for Mr. Simonds say:

His fearlessness in doing his duty, as he understands his duty, was exemplified in a case since become widely famous. On the 27th of October, 1891, he heard extended argument on the question whether Daniel Drawbaugh's application for patent on telephone was barred by reason of two years public use; the next day, October 28, 1891, he filed a decision of over 3,000 words (published at page 693, vol. 57, Official Gazette) that the invalidating public use had occurred. The next day, October 29, 1891, the examiner in charge of telephone applications laid before him the papers of Emile Berliner's application for patent on telephone then pending in the Patent Office for more than fourteen years. This was the first knowledge Mr. Simonds ever had of the existence of Emile Berliner or of any application for patent by him. He now learned that in killing the Drawbaugh application he had, unknowingly, freed the Berliner application from its threatened interference complication therewith and that he must either issue the Berliner patent or cut up some fresh maneuver with the application and so pass it on to his successor. Within an hour of his first acquaintance with the Berliner application he ordered the patent to issue. This action was made before Mr. Simonds had been 50 days in office and before he was confirmed by the Senate. It remains to add that the U. S. Supreme Court, in its decision made May 10, 1897, vol. 17, Sup. Ct. Rep., p. 809, approved Mr. Simonds' action at every point.

It might be well to correct the impression, which it is evidently the intention to convey in the concluding sentence, that the Berliner patent was sustained. The charges brought against the Patent Office were not sustained. The claims of the patent have not been passed upon by any court of competent jurisdiction, and the value of the patent is variously estimated, according to the position of those passing judgment.

Extensions and Improvements.

The new telephone line from the California mine to Graniteville, Cal., will be built soon. The distance is about four miles.

An agent of the telephone company at Gilroy, Cal., has been soliciting subscribers for a telephone line from Gilroy to San Felipe.

Superintendent Keyser of the telephone company at Covina, Cal., is considering the proposition to put in a line to Irwindale and one towards Glendora.

An ordinance granting J. M. and B. Stephins a franchise to build a telephone line from Murphys to Sheep Ranch was passed by the supervisors at San Andreas, Cal., on September 23d.

The Flagstaff, Ariz., Mutual Telephone company has been incorporated by J. Clark, A. T. Cornish, T. E. Pollock, and others, to construct and operate telephone and other electric wires in Coconino County, Arizona. The capital stock is $5,000.

An English telephone construction firm is introducing "household" telephones in Leicester. Where an electric-bell system already exists, it is possible by this arrangement to add the telephone service as well without extra wires. It is only necessary to have near the bell pushes a telephone set, and near the bell indicator an apparatus of similar appearance, or square base, with slightly different internal connections. The bell indicator and pushes can be used as with only a bell system, it being easy to denote by an extra ring when one wishes to communicate with the domestics by telephone.

American Institute of Electrical Engineers.

The meeting of the Institute in New York on September 28th was presided over by President Kennelly. A paper was presented by Charles P. Matthews, W. H. Thompson and J. E. Hilbish on "The Photometry of the Enclosed Alternating Arc." In the absence of the authors the paper was read by the secretary. The discussion was opened by Louis B. Marks and continued by W. H. Freedman, Capt. John Millis and Dr. Kennelly.

As a result of their investigations the writers of the paper announce that they are fully convinced that the lamps of low economy could, by improvement in mechanism, be brought to a performance equal to that of the most efficient lamp considered. All the lamps tested, with one exception, were furnished with the same brand of carbons. With similar carbons and similar globes, a difference in economy must be attributed largely to the mechanism.

In conclusion the writers say: "If the alternating arc be regarded apart from any regulating device, the physical reasons for its poorer qualities as a light source are to be found in the lower temperature of the glowing points and in the diminished area of crater surface. In the direct-current arc, we find two bright surfaces of unequal area and of widely different temperature. In the alternating-current arc we find two bright surfaces of the same area and of the same temperature. According to Rossetti, the temperatures in the first case are 3,900 C. and 2,700 C. Now the points in the alternating arc are as much positive as negative, and hence, whatever the unknown law connecting the temperature of glowing carbon with the intensity of the light due to it, we should expect the mean spherical intensity of the alternating arc to have a value intermediate between the values of mean hemispherical intensity for the upper and lower lobes of the distribution due to the direct-current arc. A comparison of lamps tested shows this point, although the total power is not the same. If the power consumption of the alternating arc were raised from 327 to 384, it is very probable that the mean intensity would be found raised from 110.5 to a considerably higher intermediate value.

"The values of the intensity of the direct-current lamp are lower than those found by some earlier observers. In fact, the enclosed arc has been reported in some instances as quite equal to the average open arc. It is difficult to see how these results can be accurate for a lamp fitted with an opalescent globe. The results of a test recently reported by Nichols agree closely with those given for the direct-current lamp in this paper."

At the meeting of council in the afternoon the following-named associate members were elected:

William Frederick Carter, London, England; Walter H. Coleman, Andover, Mass.; Henry L. Doherty, Madison, Wis.; George W. Frank, Jr., Kearney, Neb.; R. H. Mansfield, Jr., Bronxville, N. Y.; Kempster B. Miller, Scranton, Pa.; Gilbert Rosenbusch, South Orange, N. J.; John West Thompson, Guadalajara, Mexico; Henri Tripier, Paris, France; Herbert A. Wagner, St. Louis, Mo.; William Henry Williams, Bozeman, Mont.

Carrying United States Mail on Interurban and Street Railways.[1]

By W. S. Dimmock.

There is probably nothing which is of more importance to the perfection of an absolutely satisfactory mail service than the saving of time. The electric canceling machine and the numerous contrivances of the manufacturers' craft employed in the handling of mail matter aim at the one end, economy of time. This is probably the most potent argument in favor of the electric-car service for the transmittal of mail matter to and from depots and between sub and suburban stations and the main postoffices. As a general proposition, the schedule time of the electric cars is absolutely to be depended on. Experience has demonstrated that the list of casualities likely to interfere with the progress of a car upon its designated route is smaller than that which often hinders the wagon service. In the case of the Omaha office, where I have had the best opportunity for observation, a noticeable gain is made in the service between Omaha and Council Bluffs, a distance of five miles, and Omaha and South Omaha, the same distance. Here the advantage is not confined to the saving of time but in the increased number of trips it is possible to make. The frequency and regularity of time on the electric-car lines make it possible to dispatch mail matter from one office to another, or from the main office to sub-stations, to the best possible advantage, since the time can be regulated by the dispatching office at will in order to meet certain outgoing trips of carriers, which might be impossible to reach if the regular running time of the regular mail trains had to be considered, or the possibility of using the wagon service depended upon. Before the use of the car service for this purpose, and when the railroad had to be depended on for the transmittal of mail between Omaha and Council Bluffs, Omaha business men frequently asserted that it was easier and more satisfactory to transact business by letter with Chicago than with Council Bluffs. Almost as broad a statement might be made in regard to South Omaha. As an example of the difference in the two modes of service, the Denver fast mail, which reaches the Omaha office via the electric cars at 4:18 p. m., gets into the hands of the city distributers from 10 to 15 minutes sooner than when the wagons are depended on; this means the handling of an immense number of letters which reach the carriers in time to be taken on their last afternoon trip and delivered to the patrons of that office on the afternoon of the same day, instead of the following morning, and prevents a delay of something like 17 hours. This great advantage, of course, relates to letter mail, which is the first to be considered; the advantage is obvious, if you happen to be in a position to observe the difference in time when the letters are conveyed by the cars as contrasted with that at which the wagons deliver the papers brought by the same train. In the interim between the two deliveries the letters have been tossed on the table, back stamped and have found their way into the deft hands of the distributers and are being rapidly sent to their ultimate destination.

One can only realize the vast importance of 10 or 15 minutes under certain conditions when he has watched the distributing of a fast mail; what hours and days are to man, moments are to letters. A clerk in the Omaha office said to me recently: "The return to wagon service from the electric-car system would be a plunge backward into the dark ages, which I trust we shall never experience." Mailing clerks and distributers alike are unanimous and even enthusiastic in their commendation of the electric cars as a means of transit for mail matter, so far as I am advised. Where sub-stations are supplied from a main office, the advantage of the cars admits of no question; the time saved in the actual transmission of the mail between these points is about one-half the time consumed by wagon service, so that where the carrier service enters in as a means to be considered, the patrons of the outlying districts are given immeasurably better and more satisfactory service. When this great system shall be utilized everywhere for the collection of mails over the cities, when the actual labor of "working" and routing of the mail shall be performed on the postal electric cars as they thread their way through the very heart of commerce, and a letter finds its way, yet warm from the hands of the writer, to the depths of the mail pouch, then it will seem as if system could reach no higher pinnacle of development.

Again, I wish to make another comparison of time saved by using the electric railways to carry mails. Before the electric line between Omaha and Council Bluffs undertook to handle the mails between these cities, the mails left the main postoffice by wagon and were conveyed to the depot of the Union Pacific railway, which is a distance of a mile in Omaha and one mile and eight-tenths in Council Bluffs, where they were then conveyed by train across the river, a distance of five miles. The Union Pacific at this time had about 11 trains in 24 hours, and part of these trains at night, after business hours were over for the day, thereby making the mail service so very unsatisfactory that the public began to clamor for the mail to be carried by the electric railway from the time the road was open. We finally made a contract with the government to carry the mails between the two cities, and

1. Read before the American Street Railway association, at Boston, September 7, 1898.

the public discovered at once that we were transporting these same mails from Council Bluffs to Omaha in the same time that it formerly took to deliver the mail by wagon from the Council Bluffs postoffice to the Council Bluffs depot, thus saving the time consumed by the Union Pacific train between the cities and time consumed by wagon from depot to postoffice in Omaha. In fact, the mail was probably in the hands of its owners and answered, in some cases, long before it would have crossed the river by the old route. A man could mail his letter in Council Bluffs, walk to Omaha and wait for its delivery under the old system, while the new route makes it possible for him to mail a letter when he goes to his office in the morning and get his answer by noon. No doubt an investigation would prove that the same conditions exist in nearly every state in the Union at hundreds of places.

Now let us investigate the compensation. After it was discovered that the electric railways could handle the mails with so much satisfaction to all concerned, the managers of the railways thought they saw a great protection during strikes, etc., in the government, and they were ready to carry the mails at almost any price, but I believe experience has taught us, through some of the strikes in the East, that they did not find the protection anticipated. The electric-railway managers were figuring on the basis of what the government had done for the steam roads during such troubles, and while, seemingly, the comparison was a good one, it was erroneous, from the fact that a mail car could be attached to an engine hauling 10 or 15 coaches of passengers, and this one train would perhaps clear up the traffic for hours, while with the electric roads, where the headway is anywhere from two to five minutes in large cities, where strikes are liable to occur, one train carrying the mail which the government would protect would make no more impression upon a congested travel than would one drop of water in the ocean; therefore it can be shown that the only benefit received by the companies for carrying the mails on street and interurban railways is the compensation allowed by the government for the same; hence the railways should work with an end in view to make this compensation enough to justify them in looking upon the carrying of mails as a profitable earning, and one which should receive their careful attention. It is true the government has made some effort to arrive at the cost of carrying the mails, but in doing so, if you will read the report of the committee to the postmaster-general, under date of June 25, 1896, which the government at Washington will furnish you upon request, and which contains a great deal of valuable information, you will see that the report treats mostly upon finding out what expense the railways are put to in handling the mail, and not the value of the service to the public. This report makes an allowance of three cents per mile for carrying pouches upon electric trains, while in the same report the following statement is made: "The closed pouches upon the street cars should be compared with the Star service, which it replaces," and the government states that "the Star Route service costs 4.94 cents per mile," yet the committee commends three cents per mile only for the electric service with its increased speed, prompt and reliable handling, and, in fact, a superior service in every sense of the word. Following this statement, the report also says: "It is gratifying to report the improved service will not materially increase the expenditures of the Postoffice Department." Why? Because we, the managers, have allowed the government to dictate to us what we should have dictated to them, and it offers us for a better service less than it has paid for the same service by wagon, simply on the grounds that the service costs us but little, if anything; yet, in figuring what it costs us, the government does not take into consideration, as a rule, any expenses for damages, general expenses and especially fixed charges. Where the regulation wagon service in cities is costing the government 15.7 cents per mile traveled, it only offers the electric companies 16 cents per mile for a 16-foot car, and at the same time claims the service would be far superior and the car would take care of the natural increase for years to come. Does it not look unreasonable for the government to dictate to the railway companies such terms when the service is so much superior to the wagon service? In Council Bluffs the government pays more for the wagon service to haul the mails to and from the depot, a distance of 1.8 miles, than it pays the steam road for hauling it from Council Bluffs to Omaha. Why? Simply because the steam roads are post roads and compelled to carry the mails as the government dictates, while in the wagon route it is dealing with an individual, and it is impossible to make a contract for any such unreasonable terms.

When the Omaha and Council Bluffs Railway and Bridge company first closed the contract with the government for carrying mails between Omaha and Council Bluffs, the government allowed the company $100 per month, and was satisfied it was getting value received, until other electric roads commenced to carry the mails more for protection than revenue. The government immediately took advantage of the opportunity to make an investigation, and the report of June, 1896, was the result, reducing our compensation to $50 for nearly the same service. Had the American Street Railway association handled this matter as general managers and passenger agents of steam roads handle their affairs, the result of the government committee's investigation would have been different.

No doubt the companies spoken of in the committee's report to Postmaster-general Wilson, under date of June 25, 1896, where they give information as to the cost of carrying mails and operating mail cars, have since then learned, through experience, that their estimates were entirely too low, although given in good faith at the time. The Chicago City Railway company stated that the revenue derived for running mail cars barely pays the expenses. Nearly every manager with whom I have communicated is dissatisfied with the remuneration. And here allow me to add that the running of mail cars in large cities, like New York and Chicago, is of vastly more importance to the government than it is willing to admit; while, on the other hand, to run these cars on regular trains is annoying to the passengers, from the fact that where they are supposed to stop at sub-stations, connecting points, etc., the passengers are annoyed by the wait of a minute or so, and the result is the car is run as a special exclusively for mail, making it more costly to operate. Yet the government is basing the compensation upon the same basis as postal cars for steam roads, and we, as managers of electric roads, are allowing it to be done with all statistics before us to prove that the steam roads are not securing the remuneration they should. To prove this I respectfully refer you to some excellent articles in detail upon this particular subject in the Railway Age, published at Chicago, December 31, 1897, and March 11, May 20 and 27, 1898. Congress has already appointed two commissions to investigate this subject, known as the Gardner-Hubbard commission of 1877 and the Elmer commission of 1884. These commissions made elaborate reports advocating increased pay, based upon speed and space. The recommendations were not acted upon, for the reason that the railroad companies themselves, without extra pay, have been found to increase their speed and enlarge their space, and thus the government has actually received these advantages under the operation of the law as it stands. The steam roads had done more than their part, while the government took advantage of it and refused to act. The government has always been in the position of a beggar regarding facilities demanded of the steam roads for handling the mail.

In December, 1897, a great cry went up from Washington as to how the steam railways were swindling the government. This led to an investigation, and, had I time, I would like to quote the results of that investigation in detail. Suffice it to say, that this charge was ably answered by Mr. E. P. Ripley, president of the Santa Fe railway, and the charge denied by the Chicago Times-Herald. The government was making thousands of dollars off of the railways, through the arrangements of only weighing mails every four years and obtaining car space unpaid for. For illustration, in these statements sent out from Washington, it was claimed that the amount paid by the government to the Erie road for the transportation of mails had been sufficient to pay a dividend of six per cent. per annum upon all the stock of the road. The stock of that road is $150,000,000; six per cent. per annum would be $9,000,000; the total mail pay of the Erie road is less than $500,000. Such statements as these place this matter in a false light, and, if after years of experience the steam roads are not in a position to obtain proper rates for handling of mails, what will be the condition of affairs between the electric railways and the government if no effort whatever is made upon the part of the management of electric railways to look after this matter now? I realize that it is a hard matter for the government to make a flat rate to cover all roads and the local conditions pertaining to each road; but as it has attempted to do this, I claim that it should have made the rate high enough to the electric railroads to make them become at least interested in the subject, and that three cents per mile for pouch service and 16 cents per mile for 16-foot cars, which are fast becoming obsolete and replaced by cars from one-third to twice as large, is not enough. The government will naturally take advantage of the larger cars as it did where advancement compelled the steam roads to increase the size of cars, speed, etc., but I doubt if it will increase the compensation of electric roads or take this question into consideration when figuring on cost of operation.

It is not for me to say how much we should receive, but for the members of the convention to take up the subject for discussion and work it out. This class of service will grow from year to year, and after a while be worth thousands of dollars to us annually, and what we do to-day and what we neglect is laying the foundation for the government to work upon in the future. Then it behooves us to be on the alert and lay the foundation of the compensation so well that the government cannot tear it down when the time comes for it to declare the electric railroads as post roads, etc.

For the present we are compelled to abide by the appropriation of Congress and the rates made by them; but the question before us is, How can matters be improved for the benefit of electric railways in the future? This convention represents as many millions of dollars of investment, I believe, as any other body of men coming together each year in this country. It contains men whose power is felt in every community. In unison there is strength, and if you, gentlemen, will take up this subject, discuss it thoroughly, and when you have reached an understanding, go home and lay the matter before the congressmen from your districts, you can convince them of the good the electric railways can be to the public in carrying the mails, and it will only be a question of time until the influence of these efforts is felt at Washington, and something more substantial than glory and patriotism will be our reward for carrying the United States mails.

Discussion.

C. S. Sergeant, Boston: I have some data of our experience in Boston, which might be of interest to the members. In 1895 our company was approached by the Postoffice Department to see what could be done in the establishment of a trolley-mail service, but, as the writer of the paper has said, there was not sufficient money available for the purpose, except some funds left over from the "wagon fund." We undertook to inaugurate the service, and take what revenue might be gotten by a transfer from this fund, as a test of the feasibility of the scheme. This was the first city in which the trolley mail cars were handled in the same manner as the steam-railway mail cars; that is, with a messenger and clerks to assort the mails on the car. We began in 1895 with seven mail cars which we equipped, and for the information of the association I will present a memorandum which I have concerning our trolley mail cars.

Trolley mail cars inaugurated May 1, 1895; night service inaugurated June 3, 1895.

Number of Trips.

	Week-days.	Sun-days.	Holi-days.	
Started with	43	18	18	12,670 trips yearly
Same year increased to	43	20	20	130,000 miles yearly
In 1896 increased to	47	20	20	14 315 trips yearly
In 1897 increased to	47	19	21	15,409 trips yearly
In 1898 increased to	47	19	21	15,517 trips yearly
In 1898 mileage will be upward of				170,000 miles

There were originally 12 stations, to which have been added one at Charlestown, January 1, 1897, and one at Roxbury Crossing, February 1, 1898, on which date also a punch service was established between Somerville and West Somerville. Connections have always been made with the Boston and Albany and Providence depots and the Union station. Sixteen men are constantly employed, eight conductors and eight motormen.

Out of about 45,000 trips run (to January 1, 1898) there were 360 failures or irregularities, or 0.8 of one per cent., and that was almost wholly due to the snow and the consequent blockading of teams in the narrowest streets. Seven cars handle 100,000 pieces of mail daily.

The system is under the supervision of the New England superintendent of railway mail. In other cities the trolley and cable service is under control of the local postmaster. The general superintendent of railway mail of the United States, in his report for 1895, says:

> In Boston, by reason of the fact that the street-car lines are all under one management, we are able to move mails from one suburb to another, as, for instance, from North Cambridge and Cambridgeport to Brookline, by direct transit, the mail not being compelled to pass through the main office. There is probably no city in the country where the benefits of this service will be as great as in Boston, with its densely populated suburban districts, all of which have heretofore been more or less restricted in their mail accommodations by reason of their mail having to go through the city postoffice. By the present system, the railway postoffices centering in Boston can pouch to the street-car lines all mails for suburban points reached by them; and the street-car lines in turn can gather up all the mail from suburban points and pouch it direct to the departing trains at the various depots.

The first practical illustration of a street-railway postoffice was in Boston. Other cities had street-railway mail cars earlier, St. Louis and Brooklyn, where the mail was simply carried in bulk and delivered the same as by teams, not being worked in transit; but Boston street-railway cars were the first to be patterned after steam-railway cars, with racks and all appliances for working the mail in transit—transferring, so to speak, so much working space and clerks from the main postoffice to the postoffice on wheels, thereby losing absolutely no time in handling matter, and enabling the business man to get his mail early in the morning rather than late in the afternoon, with nearly a whole day saved for him. One car is equipped with an electric canceling machine, with a capacity of 2,000 cancellations an hour.

Let us follow a car to North Cambridge, touching Park Square, Cambridgeport and Cambridge postoffices en route. Take the first trip in the morning, where the postal clerk receives from the general office the accumulation of mail which arrives during the previous evening, from all parts of the country. Upon arriving at Park Square station the train from New York with mail from the South and New York state, which arrives at 5:30, is met and its mail is delivered direct to the postal car, the contents opened by the clerk and assorted for the carriers. Upon the arrival of the car at Cambridgeport, a 15-minute run, the mail for the station is about ready for delivery to the carrier. This also applies to Cambridge and North Cambridge. Now this car receives mail collected at the several stations along the line and assorts it in the car, inward, for all outgoing trains, so that when it reaches stations en route or Boston, the mail is ready for immediate dispatch.

Each car handles nearly five and a quarter million pieces of mail, or a total of 36,561,170 pieces for the seven cars, in a single year.

The mail service, as carried on here, is not merely carrying it from a station to the postoffice. Our

method is practically a traveling postoffice, and each car is practically a branch of the general postoffice in Boston, which receives mail from the trains, assorts it and gives it to carriers, so that, without question, the average suburban mail here is two or three hours earlier in its delivery than it would be without this service.

What the writer of the paper says about the question of compensation I think is very true and important. I believe that something might be done by the association. We have never received a compensation which has more than paid our running expenses. I think that any rate that should be fixed in an arbitrary manner, so much a car-mile for carrying the mail, is entirely unfair. It all depends, it seems to me, on the conditions; what service is rendered, what the character of the service is, whether combined with passenger service or whether it is done with independent cars, and what the local conditions of expenses are. For example, I know that there are some street-railway lines whose gross receipts from passenger business are not equal to our operating expenses for conductors and motormen in Boston. I have no hesitation in saying that the average expenses here per car-mile for conductor and motorman run to about 7.5 per cent. The hours for labor are 10 hours in 12, fixed by law, and the compensation is $2.25 per day and 30 cents an hour for trippers.

In some other cities the conditions are quite different; possibly they pay higher wages. On the other hand, some mail routes are one straightaway suburban route, where a rate of 10 cents a mile would be a good rate, compared with one at 30 cents a mile where the conditions are like those in Boston.

Congress needs enlightenment. It does not comprehend the fact that the street-railway service is better than the steam-railway service and is of a different character, and something which is such a public benefit that it would be a pity to have it stopped, and yet we cannot afford to keep on unless we are properly remunerated. I am not without hope that something may be done through our association by getting at the conditions of service through the secretary, in correspondence with different cities. That might be done in an official way to find out what the various conditions are under which different roads which are members of our association are carrying mail, and what they are willing to do in the shape of concerted effort to bring these facts before the members of Congress who have to do with these matters. Our Postoffice Department is like all government departments; it only sees so many general things and not all the details that go to make up expenses and secure perfect service, but I believe it means to be fair, and if the true facts are put before it we shall probably be able to get a reasonable compensation for this service.

John I. Beggs, Milwaukee: The Milwaukee company, at the present time, is going through the preliminary stages of establishing a mail service upon its lines. I had presented to me by the postoffice officials at Milwaukee the report of the second assistant postmaster-general, in which I found that there had been paid, not 16 cents per mile, but in many cities, as shown by the report for the year 1896, 11 cents per mile, which is considerably below the cost of operating a car over the line, yet that car is supposed to be given the right of way at all times in order to make the service satisfactory. I found that the wagon service was costing nearly double what the government expected us to give a very much superior service for. It seems to me that it is time this association should appoint a committee to take this matter up with the government and establish some fair basis of remuneration. There are kinds of service that could be given in one city that might not be possible in another. In Milwaukee we could displace the wagon service, because we control the entire street-railway system, and the peculiar location of the various lines, reaching to all the suburbs and running directly through the city, east and west and north and south. It is proposed to do away with much of the carrier-collecting service, by having districts in certain sections of the city and the carriers serving as collectors of mails, bringing it to one central point where the mail car would pick it up periodically.

As to the question of carrying mail pouches on the regular cars of the systems, I seriously question its advisability. It may possibly be necessary in some of the smaller cities. I am free to say for the Milwaukee company that I do not favor carrying mail pouches on the platforms of our cars. The platforms, as we all know, are too valuable to use to carry a mail pouch at three cents a mile, and it would very greatly inconvenience the patrons on the line, many of whom insist on using the platforms, whether you like it or not. It seems to me that if this association would appoint a committee to take this matter up in behalf of the street railways of the country, that committee could confer with the government officials and establish some fair basis of remuneration, not simply for the purpose of having street railways established as mail routes, but, as in the case of steam railroads, a source of revenue and profit. I think this is the proper time to do it, because the street-railway mail service is established in a comparatively small number of cities. I understand that in Cincinnati, as Mr. Sergeant has stated, the cost of running the mail cars is about what is received from the government, without any profit or compensation for the wear and tear or anything of the kind.

Robert McCulloch, St. Louis: I would state for the information of the association that one of the roads in St. Louis made a contract with the government to carry the mail, and had two cars built especially for the purpose. The compensation was entirely inadequate for the service alone, not counting the investment in special cars. The company expected to derive a benefit by being able to designate its road as a United States mail road, and had the inscription made on the cars "U. S. Mail." As soon as the cars appeared on the streets, at the suggestion or interference of somebody, no one knows who, the government required the sign to be taken off all the cars.

Mr. Dimmock: After an investigation and a conference with a number of government officials, I think the secret of our success will lie in acting together as a body, and in not attempting to secure recognition as post roads. The government treats us now as individuals, and if the committee will keep that point in mind it is in its power to dictate to the government the terms, instead of the government dictating to us. That point is a critical one, and if we allow the present rates to continue the time will come when the government will require us to carry the mail at the rates it pays the steam roads. It is the most vital point in the whole subject.

Henry C. Payne, Milwaukee: Recently I had an interview with the postmaster-general and assistant postmaster-general in regard to this subject. I found these gentlemen much interested in this question, but the difficulty with them is lack of funds. The trouble lies back of the department. It lies in the appropriation available for this purpose, and you will have no difficulty, I think, in getting a reasonable compensation from the departments if a sufficient appropriation is made by Congress. I think largely the trouble lies there, and I have no doubt that if the committee from this association will take the matter up and present it properly to the committee on appropriations, having in charge the postoffice appropriation, you will secure a very large increase. I have found the department officials willing to investigate the situation in different cities and to act as far as the means at their command will allow; and I have no doubt that the methods proposed will be the proper ones to pursue. But, of course, it will require that the gentlemen selected, if they hope for success, visit Washington and press the claims of the street railroads on the proper committee of Congress, before taking up each individual case with the department. I am thoroughly in accord with the resolution, but the committee will find that it has more to do than gather statistics and information. It will be necessary to go to Washington and present the case to the proper committee of the House of Representatives.

Municipal Electricians to Revise Their By-laws

Chairman Ellett of the executive committee of the Association of Fire and Police Telegraph Superintendents and Municipal Electricians has issued a call for a meeting of his committee for October 8th, at Wilmington, Del., the home of the president of the association, Mr. John W. Aydon. The following-named gentlemen compose the committee: W. Y. Ellett, superintendent fire telegraph, Elmira, N. Y.; M. W. Mead, city electrician, Pittsburg, Pa.; Captain William Brophy, chief electrician Wire Inspection Department, Boston, Mass.; W. H. Thompson, city electrician, Richmond, Va.; F. C. Mason, superintendent police telegraph, Brooklyn,, N. Y.

The committee, at this meeting, will revise the by-laws of the association and decide upon matters pertaining to the next regular meeting of the association, which will be held at Wilmington, Del., September 5, 1899. All members of the association are invited to be present at this meeting of the executive committee. President Aydon has arranged to entertain all who can make it convenient to be present. Applications for membership will also be received and acted upon at this meeting.

Chicago Rheostat Company and Its Product.

The electrical trade in general will be interested to know something of a new rheostat and general electrical manufacturing company that has recently opened business in Chicago, and one that is reported as having already met with most flattering success.

The Chicago Rheostat company, 1649-50 Marquette building, Chicago, has but newly embarked in the rheostat field, and its success may be said to be assured, as at the helm is the experienced hand of E. W. Hammer, so long connected with another rheostat company which still bears his name. Mr. Hammer's efforts have been such that a brilliant future is predicted for his new company.

In addition to a full line of standard motor-starting and controlling rheostats, the Chicago Rheostat company will furnish the complete and well-known line of special pump and elevator controllers made under the Whittingham patents; also a full line of dynamo field rheostats, using the new enameled resistance-unit system, recently patented by the American Electric Heating corporation. This very comprehensive list is listed in the company's new catalogue, an attractive pamphlet, bound in raw silk copiously illustrated, and arranged with special regard for the convenience of the purchaser.

One of the best guarantees that the products of the Chicago Rheostat company will be of the highest standard in each detail is the association with it of J. D. Claghorn as superintendent. Mr. Claghorn occupied a similar position with Mr. Hammer's old company from its inception until a very recent date, and has been intimately connected with electrical manufacturing for the last 15 years.

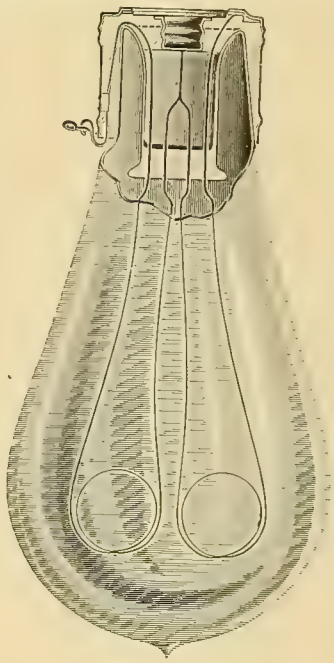
The designing department of the company will be in charge of F. S. Hurst. Mr. Hurst was chief of the draughting department of the Cutler-Hammer Manufacturing company, so this very important branch of the business is assured of competent expert service.

As an evidence of the company's progress to date it reports the receipt of orders for rheostats during the last two weeks aggregating 464 horse power, ranging in size from one-eighth to 100 horse power.

Duplex Incandescent Lamp.

The accompanying cut shows the Duplex lamp, made by the Fostoria Incandescent Lamp company. For this lamp the company makes four claims: First, that if burned at ordinary candle power, using each filament separately, it will last as long again as any lamp on the market; secondly, that by the use of the incorporated switch, the candle power of the lamp can be doubled at will, and turned back to normal candle power at will of the user; thirdly, that, both price and efficiency considered, it is the most economical and practicable lamp yet brought out, and fourthly, that it can be used in all standard bases without any change, expense or inconvenience.

The Duplex is especially strong and showy with



DUPLEX INCANDESCENT LAMP.

its double filament, and it radiates a strong and beautiful light. The filaments are perfectly poised, and when the full power is turned on, it gives 32 candle power, while, if for any reason it is advantageous to have less illumination, by the use of the switch the one filament can be thrown off and the other can be left burning at full 16 candle power. Users of incandescent lamps wishing to make a test of this lamp can obtain free samples by applying to John W. Brooks, the western manager at Chicago, giving the voltage and base of lamp required.

The English Awakening.

[From the Trade Journals' Review of Manchester England.]

We do not complain of this activity on the part of our transatlantic cousins; we only ask for a fair field, and that our manufacturers may be be untrammeled by fiscal burdens, or heavy transport rates. But, undoubtedly, John Bull will have to bestir himself, and arm for the conflict. He may find it necessary to take a leaf out of Uncle Sam's book. He is said to be too independent to make a good salesman. That may be true of him when, without putting himself about, he can sell all he can produce. But let him learn to produce more, and to do so more cheaply. If he is to retain his hold on the world's markets, his prices must be satisfactory as well as his goods. But in order to do these things he will have to discard many antiquated methods, and to consign many old-fashioned machines to the scrap-heap, to be replaced with the best of their kind. With better machinery, and heartier co-operation from his workmen, he need not fear of being able to hold his own in all markets.

Duty to Keep Electric Wires Out of Way of Citizens in Alleys.

The Supreme Court of Missouri holds, in the case of Gannon against the Laclede Gaslight company, that the plaintiff's petition was complete when the charges had been made that her husband had met his death upon one of the public alleys of the city, in the discharge of his duty as fireman, and without fault upon his part, by stepping upon an electric wire of the defendant charged with electricity, which the defendant had negligently suffered to become broken in two and fall to the pavement of the alley.

The other averments of carelessness on the part of the defendant, that it knew, or ought by the exercise of care and caution to have known, that the wire was broken and liable, if touched by a human being while so broken and charged with electricity, to destroy human life, and the fact that the act of negligence as alleged to have occurred after the particular manner detailed in the petition was not shown in all its fullness, the court further maintains, were not fatal to a recovery of damages, if sufficient was shown to have made a prima facie case of negligence under any of the charges made, and constituted no disregard of the rule of pleading and practice that prohibits variance between allegations made and proof shown.

It is scarcely necessary to assert, continues the court, that it was the duty of the defendant company to so keep at all times its electric wires, over which was continuously being transmitted that "most dangerous energy, force or fluid known to man called electricity," out of the way of the citizen, that contact with them would not occur as he went to and fro in the prosecution of his business. It was a matter of the plainest duty for the defendant to see that the streets and alleys of the city, along which, by permission, it was suffered to place its overhead wires for its own private gain, were at all times maintained in the same condition, as to safety from the danger of electricity, as they were before its overhead use thereof was begun; and a most imperative duty was placed upon the defendant, in assuming the overhead use of the public alley with its wires, to see that persons passing along and using the alley were not injured thereby; and when proof, under the allegations of the plaintiff's petition, was made, showing that one or more of the defendant's wires charged with its death-dealing force was down upon one of the public alleys of the city, and that the plaintiff's husband met his death in the discharge of his duty, a prima facie case of negligence was made out against the defendant, and the burden was then upon it to show that its wires were down in the alley through no fault of its agents and servants.

South American Trade.

South American markets should be diligently studied by American manufacturers. It may be truthfully said that American manufaciurers are establishing a good reputation in South America, and increase of trade may confidently be looked for; but there, as elsewhere, competition is increasing.

From reliable and trustworthy sources it is learned that there is a good demand in most of the South American countries for electrical machinery, fittings and kindred lines. During the year 1897, the Argentine Republic imported 16,081 tons of galvanized iron wire, valued at $1,005,777; also 35,216 dozen incandescent lamps, 5,123 cases of general electrical material, 52 dynamos, 529 cases of telegraph material, 318 cases of telephone material, together with other electrical appliances. In addition, recent estimates on electric-railway materials sent to Argentina by manufacturers of the United States represent upwards of $2,000.000.

Many reasons have been given why the South American trade lacks vitality. The first and principal reason can be stated in a single sentence: A lack of capable traveling salesmen for special lines able to speak the Spanish language. American banks, steamship lines and large stores are all important, but they must follow the results of the efforts of American salesmen. The New York export commission houses which are doing business in the South American countries are doing good work, but they could do much better if the American manufacturers would co-operate more fully with them in sending traveling salesmen and issuing proper catalogues in Spanish and Portuguese.

It is recommended by men of experience that American traveling salesmen be employed and that distinctive American importing houses be established. It is predicted that in due time will follow regular lines of steamers under the American flag and the opening of American banks wherever required. A. F. T

Railway Generators Driven by Gas Engines.

The gas-driven plant for the electric railways at Lausanne has now been working, without hitch, for over two years. The generators are of 130 horse power each, and economical. A description of the plant recently appeared in the Génie Civil. The company had among many offers one from the Paris firm of Heurtey & Fichet, to supply mixed gas power at a maximum expenditure of 625 grammes of coal per effective horse power hour. The company accepted, and that figure has never been exceeded. There are three gas generators, and room is provided for a fourth. The coal is used in small grains. The mixture of air and steam, which is fed, is superheated in a tube around which the hot gas plays, which leaves the generator at a temperature of 600° Centigrade. The cooled mixed gas passes into a gasometer. The water reservoir of 230 cubic yards capacity is built in Hennebique cement. Each two-cylinder Crossley engine is coupled to a Thury generator of the Compagnie de l' Industrie Electrique, Geneva, by means of Raffard rings. The accumulator battery of 300 Pollak cells helps to start the gas engines. The 25 cars, each arranged for 32 seats, are each fitted with two 20 horse power Thury motors. The conductors are stretched on Mannesmann steel tubes. The line has a length of about eight miles and is hardly anywhere straight. During the first half of 1898 the total amount of coal consumed in the power station amounted to 9.32 grammes per kilowatt.

Consolidation of the Elevator Companies Reported.

It is reported that a consolidation of all the prominent elevator-manufacturing companies of the country has been effected. It is said that such concerns as the Crane, Hale, Otis, Standard and Sprague companies are embraced in the deal, and that all classes of elevators—hydraulic, electric and steam—are involved. The statement is made that the headquarters of the management of the combination will be in the East.

CORRESPONDENCE.

New York Notes.

New York, October 3.—An important Brooklyn street-railway consolidation that seems to have been effected is that of the Brooklyn Rapid Transit company (capital stock, $20,000,000) and the Nassau Electric Railroad company (capital stock, $6,000,000; bonds, $4,849,000). This means a practical combination of all the surface street-railway interests in the borough of Brooklyn, as the two companies named had before taken unto themselves all the others. The Brooklyn Rapid Transit company will be in control. It is possible that an arrangement will be perfected by which the Brooklyn elevated railroad companies will be taken into the combination.

The Metropolitan Street Railway Employes' association celebrated its second anniversary on Saturday night at Carnegie Hall. The association was formed for the purpose of securing mutual insurance and taking care of sick members. It has paid out $3,000 in insurance, spent as much for sick benefits, and accumulated a fund of $5,000, which it has invested in the securities of the railroad company. In the winter the members hold monthly meetings, at which entertainments are given. Originally the entertainments were furnished by hired performers, but after a few months it was found that there was sufficient ability among the members of the association to provide satisfactory diversion. One of the features of the entertainment of Saturday night was the presence of about 28 employes of the road who served in the campaigns in Cuba and Porto Rico. These men are still on the sick list, and are awaiting complete recovery before taking the places they left when they enlisted.

The chairman of the relief committee of the Seventy-first Regiment Veteran association has sent a letter to the president of the Metropolitan Street Railway company to convey the committee's "keen sense of appreciation and heartfelt thanks for the great service rendered to the sick and enfeebled Seventy-first Regiment by your company upon its return to this city, and also gratitude to the officers and men of the company for their kind and efficient efforts to aid our almost helpless men. A number of these men that your company aided have since died, but your kind assistance will long be remembered by the survivors, as well as the members of the Veteran association."

The new "underground" electric cars began running regularly on the Sixth-avenue route on Saturday between Fifty-ninth street and Fourth street. An experimental trip was taken over the new road by several officers of the company at midnight on Friday, and they found the roadbed in first-class condition and everything in running order. The work of completing the system below Fourth street will be pushed with the same vigor as the company has exhibited in changing the motive power of the northern part of the line, and it is expected that within another month the whole route from Harlem to Vesey street will be open.

The Port Chester Electric Lighting company has just purchased the plant and franchises of the Westchester Gas and Electric company, and will begin in a short time to build an entirely new plant to supply the villages of Port Chester, Rye, Harrison and Mamaroneck. The capital stock of the new company is $50,000, and the officers are William E. Ward, president; J. Addison Johnston, vice-president; William L. Ward, treasurer, and Walter S. Comby, secretary. M. S.

Northwestern Notations.

Minneapolis, October 3.—The electric-power plant at Canyon Ferry, 14 miles from Helena, Mont., has been put in operation and the power transmitted to the smelters at East Helena. The test was an entire success. The plant will not be placed in regular use until some machinery is supplied for which the company has been waiting for some time.

The Twin City Rapid Transit company is preparing to replace all its short cars with 43-foot cars for all lines in Minneapolis. The company has a number of new cars in course of construction, and they will be placed on the various lines as rapidly as possible. With these cars in use, the trailer will be abandoned. The new cars will also obviate the use of open cars, for the windows are much longer than the windows on the old-style car, and when fully opened make the car quite as cool as the regulation open car. In case of a sudden change in the weather, which is not unknown in this section, the new-style cars will have an obvious advantage.

A small fire in the electric-light station at Tekoa, Wash., played havoc with the equipment. It was soon extinguished, but not before the electrical apparatus was ruined. The loss was $1,500.

The receiver of the street-railway company at Duluth, Minn., has filed a petition asking permission to pay interest on the first-mortgage bonds of the company. Thirteen creditors have intervened with small amounts, ranging from $1.65 to $174.80.

The village of Hopkins, Minn., voted $3,000 bonds to secure the extension of the electric line running from Minneapolis to St. Louis Park, on to Hopkins. They also want freight-car service several times a week.

The Devils Lake and Kilbourn Electric Railway company has applied to the council at Baraboo, Wis., for a franchise between Devils Lake and Kilbourn.

The Twin City Rapid Transit company made a vigorous appeal before the State Board of Equalization to have its assessment reduced. It claimed that the cost of the system when put in was about $10,000,000, but that it could be duplicated throughout for $3,000,000 to-day, and the assessment ought to be on the basis of what it would cost to replace it. The claim was also made that the lines were not profitable to any extent, and improvements kept the profits down to nothing.

A car in La Crosse, Wis., jumped the track on a curve and ran over the curb and onto the sidewalk, breaking a tree and an electric-light pole. The car was completely wrecked.

The electric-car line between Des Moines, Ia., and Valley Junction has been completed and put in operation. Thirty-minute service will be given.

The jury has returned a verdict in favor of the Edison Light and Power company at La Crosse. The company was sued by the La Crosse Department company, for damages resulting from a fire which burned the plaintiff's store. The fire is alleged to have started from the defendant company's wires.

A citizens' committee at Hillsboro, N. D., recommends that the city put in an electric-light plant, at an estimated cost of $5,000. C.

Canadian Intelligence.

Ottawa, Ont., October 1.—The Electric Light and Power company of Quebec is building a large power house at St. Gabriel Falls. It is proposed to establish three pulp mills at that point.

It is reported that Edward S. Jennison, a Chicago engineer, has a plan to dam the Kakabeka River, at a cost of $1,000,000, and to utilize its power for the benefit of Port Arthur and Fort William, Ont. The intention is that the towns of Port Arthur and Fort William shall get their water supply from this source, which would likewise give them a fire pressure by gravity. The power will, it is said, be sufficient to generate electricity to supply the Port Arthur electric railway as well as electric light and energy for both towns.

Application has been made to the Ontario Legislature for an act to incorporate the Toronto Elevated Railway company, such act to provide that the company may, subject to the consent of the municipalities affected, and subject to all other existing rights, construct and operate a system of elevated electric railways in Toronto and adjoining municipalities, and also in conjunction therewith a system of surface railways in Toronto and other municipalities within a radius of 50 miles.

Farmers and fruit-growers from Vineland and the township of Louth, Lincoln County, Ontario, have waited on the directors of the Hamilton, Grimsby and Beamsville Electric Railway company, at Hamilton, and requested the company to extend its lines from Beamsville to St. Catharines. The directors stated that the cost of building a line over the ravines would be very great, and they would not think of undertaking it without a substantial bonus from St. Catharines and also from the Louth Township. They further stated that their engineer was making an estimate of the cost of constructing the railway, and when his report was received the directors would come to a decision on the matter. There is no doubt that the bonuses will be voted.

The annual meeting of the Standard Light and Power company was held this week at the office of the company in Montreal. The annual report of business for the past year was considered highly

satisfactory. The year's business was the best since the company's incorporation. A contract has been entered into with the Lachine Rapids Hydraulic company for supplying current to run the plant from the Lachine Rapids in place of steam. It was decided to largely improve the station by purchasing rotary converters, fireproofing the building and making the station the most complete direct-current station in the Dominion. In addition to receiving power from the Lachine Rapids, there is also a magnificent steam plant in reserve, so that customers are doubly protected.

A practical test of the Canadian Pacific Railway company's new copper-wire telegraph circuit was made on Wednesday last, between Montreal and Vancouver, and the time consumed in sending a message to Montreal and transmitting reply to Vancouver was about a minute. The wire was duplexed, being made capable of carrying two messages in the opposite directions. After the exchange of messages, an acknowledgment was received from Vancouver verifying the statement of the Montreal people that the handling of these two messages occupied the space of about one minute. The actual distance covered by this new wire is about 2,900 miles, constituting probably the longest direct land-line circuit for daily work in the world. To pass across this distance signals only occupy one-fifth of a second. This direct circuit will enable Montreal, Vancouver, Winnipeg, Rossland, Nelson and other far western points to transact speculative business between themselves almost as quickly as between Montreal and Chicago. The alternative telegraph line to the Kootenay, via the Crow's Nest Pass line will also be completed this fall. W.

PERSONAL.

Gerald Mahony, electrician of the Lakon company of Elkhart, Ind., is visiting friends in Chicago.

Harry Gordon, city buyer of the Western Electric company, died last week. Mr. Gordon was 35 years of age and well known to the electrical men of Chicago.

Mr. Frederick Nelson of the Chicago office of the Westinghouse Electric and Manufacturing company is now in charge of the Westinghouse exhibit at Omaha. Mr. T. Julian McGill, who had been in charge of the company's display, is now manager of the Minneapolis office.

The commissioner of patents recently made an extended journey through the West. Mr. Duell was accompanied on his trip by Mrs. Duell and their three sons. They were gone from Washington long enough to enable them to visit many points of interest between the Atlantic and the Pacific coasts, including the Yellowstone Park and the Omaha Exposition. Mr. Duell noticed a slight decline in the applications for patents during the war, according to the Washington correspondent of the New York Tribune, and he attributes it to the fact that many mechanics who are inventors enlisted, for since peace has been established applications for patents are again normal.

ELECTRIC LIGHTING.

On Monday Anthony N. Brady, on behalf of the Kings County Electric Light and Power company of Brooklyn, and George Foster Peabody, on behalf of the Edison Electric Illuminating company of Brooklyn, completed the big electric-light consolidation that has been pending for many months. The Kings County company became the owner of the Edison stock, and by virtue of the ownership of this stock will own the stock of the Citizens' Lighting company and the Municipal Lighting company of Brooklyn. This purchase gives the Kings County company substantially all the electric-light business in the borough of Brooklyn.

A gas company can amend its charter to allow the furnishing of electric light, according to the Supreme Court of Ohio, which holds, in the case of Picard against Hughey, that where a corporation organized under the laws of that state to manufacture and furnish gas to light the streets and public and private buildings of a municipal corporation amends its charter so as to authorize it to employ both gas and electricity in connection with gas, such additional powers should not be deemed to change substantially the original purposes of its organization, and is, therefore, authorized by such a statute as one in that state, empowering corporations to amend their charters, except to change substantially the original purposes of their organization.

The New York Gas and Electric Light, Heat and Power company, with a capital of $25,000,000, was incorporated on October 3d at Albany. Its stated objects are to manufacture and supply gas and electricity for light, heat and power purposes in the territory of Greater New York. The corporation is to have the right to purchase and hold the stocks and bonds of any foreign or domestic corporations and exchange therefor its own stock and bonds. The organization tax of $31,250 was paid to the state treasurer by a check of the Central Trust company drawn on the Bank of America. The directors are Henry J. Hemmens, Frank D. Allen, Frederick L. Allen, J. Frank Yawger, Louis M. King, Charles N. Flint and Nathaniel W. Smith of New York. The incorporators are nearly all young lawyers. Mr. Hemmens is a partner of Samuel A. Beardsley, who is said to be associated with ex-Governor Flower in ventures in trolley lines north of New York. The incorporators are not ready to tell yet who is behind them or what their plans are.

POWER TRANSMISSION.

The Elko (Nev.) Independent says that S. N. Miller and others intend to harness the Snake River and utilize its power. Dynamos will be installed. It is thought that $100,000 will be sufficient to build a line and plant which will deliver a sufficient quantity of power at Tuscarora.

C. G. Baldwin of Claremont, Cal., has filed notice of the appropriation of water from Mill Creek to the extent of 125 miner's inches. The water will be carried to a point opposite T. R. Aker's place in the town of Mill Creek, where it will be used for power for the purpose of generating electricity to be used in Lake View, Peris, Meniffee, Elsinore and other towns in that section.

ELECTRIC RAILWAYS.

In Pasadena, Cal., an ordinance has been passed granting to George Leighton the right to construct and operate an electric railway on certain streets.

Referring to the statement that the rails, wires and poles of the Montreal Street Railway company have been judicially adjudged to be subject to assessment for municipal taxation, the controller of that company says that there has been a mistake. There has been no such judgment, he states, the question not having arisen in Montreal.

The experiment of having street-car lines owned by the municipality is to be tried in Christiania. Electric lines are to be built in the near future by the city. They are to run toward the eastern limits of the town, the purpose of the city fathers being to encourage the building of homes in that quarter. Now the growth of the city is toward the west and rents there are high. So it appears that the local government even seeks to help the humbler citizens to secure cheaper habitations. Paternalism is assuredly having a fair test in Norway.

MISCELLANEOUS.

It is said that 10 French factories are making carbide calcium for the production of acetylene gas and that four are being built. France next year will produce 3,000 tons of the carbide. Two villages in France are lighted by acetylene gas, and it is asserted that each house in these villages has its own gas-plant.

During a storm on September 26th Private Benjamin Derlouiner of Company M, Tenth Ohio, was struck by lightning and instantly killed at Camp Meade, near Harrisburg, Pa. He was detailed with a comrade to guard a tent, and when the storm broke both men sought shelter inside. They had scarcely got inside when the tent was struck by lightning. Derlouiner's comrade was stunned.

According to a memorandum from United States Consul Gilbert, at Liege, Belgium, Dr. Della Riccia, connected with the Montefiore Institute of Electricity at Liege, has made improvements on the apparatus for telegraphing with direct wires, simplifying and increasing its power. He claims that he can confine the oscillations of the transmitter to any special point, to the exclusion of all others. In case of communication between war vessels or forts, the messages could be transmitted to one alone; in case of fog at sea, the oscillations would not be limited. Dr. Riccia, it is said, can make the presence of a vessel known to another at a distance of 30 miles and telegraph messages seven miles.

George Ade gives an interesting instance of Swiss thrift in a letter from Zurich to the Chicago Record: "In my room at the hotel here there are two electric lights, one suspended in the center of the room and another fixed against the wall just above the highly swollen bed. The switch is so arranged that the first turn of the button lights the lamp in the center of the room. The second turn extinguishes it. Another turn lights the globe against the wall. A fourth turn shuts off the current. A fifth turn will again light the suspended lamp, and so on. The point is that you may take your choice of lamps, but you cannot use both at the same time."

To his many other accomplishments William J. Clark, the manager of the railway department of the General Electric company, has added that of author of a valuable work entitled "Commercial Cuba," which is being published by Scribners. The facts presented in this work were collected by Mr. Clark from personal observation and reports from reliable agents. The work contains a comprehensive picture of the conditions and possibilities of every industry on the island, each town and each district being critically examined with a view to the outlook for American capital backed by American energy. Special chapters deal with social and hygienic questions, legal procedure, political matters, public improvements, railways, both steam and electric, turnpikes and roads, harbor and dock facilities, telegraph, cable and telephone lines, contract labor, agriculture, mining and manufacturing in all of its branches, and a multitude of other subjects of interest to business men who are looking to Cuba as a field for investment or as a market for goods. The maps, plans and illustrations, together with the commercial directory of the island in the appendix, emphasize the encylopedic and exhaustive character of the work.

ELECTRICAL SECURITIES.

The Westchester Electric Railroad company reports for the year ended June 30th: Gross earnings, $127,234; operating expenses, $91,851; fixed charges, $28,943; net income, $6,439, which is $6,610 less than last year.

The Mexican Telegraph company has declared a quarterly dividend of 2½ per cent., payable October 15th, and the Central and South American Telegraph company has declared a quarterly dividend of 2½ per cent., payable October 8th.

The Coney Island and Brooklyn Railroad company reports for the year ended June 30th: Gross earnings $769,924, operating expenses $482,755, net earnings $287,169, other income $43,468, fixed charges $245,221, net income $85,416, dividends $80,374. The report shows an extremely favorable condition of business.

Trouble among the stockholders of the Syracuse Rapid Transit company has been carried into the courts in Buffalo, where Justice Childs of the Supreme Court granted an injunction in a case which has for its title the Commercial National Bank of Cleveland against the Syracuse Rapid Transit company. The bank claims to be the owner and holder of $49,000 of the preferred capital stock of the company, which is $1,250,000, and alleges that the common stock is $2,750,000. It is alleged that the defendant company has, by its officers, agents and directors passed resolutions to borrow $230,000 upon the credit and to secure the loan with notes of the company and with certain second-mortgage bonds of the company as additional security. The bank charges that the loan is to be made by certain directors, or has been procured by such directors, and that the company has passed further resolutions to pay the individuals procuring such loan, as a bonus, $30,000 in cash and all the preferred treasury stock of the company amounting to $70,000. It is further stated that the amount of the second-mortgage bonds which have been authorized to be executed and which are to be pledged as security for the loan, is $500,000. The bank says that should the company be permitted to consummate the transaction great and irreparable injury will be done stockholders of the corporation in order to benefit certain directors of the corporation, for which the plaintiff has no adequate remedy at law. The plaintiff asked for an injunction restraining and enjoining the defendant from consummating the negotiations or making the loan, or paying the bonus.

TRADE NEWS.

Kohler Bros. of Chicago are gratified with the brisk sale of Northern motors. They infer from it that business has indeed revived.

The Chicago office of the General Electric company is busy filling orders for electric-light and power machinery. A good demand is reported.

George S. Searing, the experienced and effective Chicago representative of the Hart & Hegeman Manufacturing company of Hartford, says that his last month's business with the Hart switches was the best he has ever known for any month of September. Both Mr. Searing and his customers are to be congratulated.

It is not always the good fortune of a manufacturer to have a new plant fully occupied with business from its start, nor is it usually necessary to consider at once the enlargement of the plant on account of the prospects of a greatly enlarged trade. Such, however, is stated to be the case with the rubber-insulating wire mill of the John A. Roebling's Sons company of Trenton, N. J. The company probably owes a large part of the success of this new enterprise to skill exercised in manufacture and the good reputation of all of the products of the various departments.

A handsome catalogue is that of the Western Electric company devoted to the Petite enclosed long-burning arc lamp. This lamp is designed to be used on 110, 220 and 550-volt direct-current circuits. It is very small, the length over all being 20 or 25 inches, according to type. One feature is the peculiar construction of the lamp frame. The current, which is fed from the upper carbons to the lower carbons, returns to the negative binding-posts by passing over three side rods equidistant from each other. The joint magnetic action of the current flowing through these three rods holds in balance the arc of the carbons, which occupies a position equally distant from the three rods, and the result, as claimed, is an evenly burned carbon. The lamp is made in various styles of globe and finish, and is handsome.

During the last two years the more progressive bicycle agents have taken up side lines in preference to closing their stores during the winter months. This has created a demand for staple articles which could be handled advantageously in connection with the bicycle business. In order to meet the demand for a good side line the Julius Andrae & Sons company has offered its bicycle representatives the agency for Andrae telephones and electrical supplies. Although the announcement was made but a few weeks ago, several hundred applications have already been made and the indications point to a fine sale of Andrae goods through the medium of the bicycle agents.

BUSINESS.

The Charles Munson Belting company, 28 to 36 South Canal street, Chicago, not only manufactures and sells belting and belt dressing, but it does repair work as well. Prompt service is guaranteed.

The Central Telephone and Electric company of 1123 Pine street, St. Louis, sells "everything used with telephones." In addition, it offers to repair "any old telephone" and make it better than when new.

The Eureka blow pipe is adapted for either gasoline or kerosene and is a convenient and durable tool. It is specially adapted for soldering, light brazing, burning paint, melting metals and heating soldering irons, all of which are described in the neat little circular recently issued by the Western Electric company.

The Julius Andrae & Sons company, Milwaukee, has just completed the work of installing a complete electric-light system in the Racine (Wis.) post-office. The company has also equipped Fish Bros'. Wagon Works of the same city with a complete telephone system and placed a programme-clock system in the Wisconsin state normal school.

The Electric Appliance company has just placed in the printer's hands copy for its new telephone catalogue. It claims that this catalogue will be the best all-around telephone apparatus and supply catalogue that has so far been issued. The catalogue will be ready for distribution in the course of a few weeks, and telephone companies are requested to send in their applications now, so that their names may be placed on file and the catalogue may be sent as soon as it comes from the press.

Mr. J. J. Dunn of Boston is the inventor of a useful device by which incandescent lamps in churches, theaters, public halls, hotel lobbies, show windows or other lofty positions may be either unscrewed from their sockets and removed or cleaned by a person standing on the floor below. A long telescopic handle, adapted to be arranged for any height up to 20 or 30 feet, carries rubber-lined nippers to grip the bulb. A toggle action is connected with the nippers by a braided cord carried down through the center of the springs and inner tubing and made fast to a ratchet lever, the turning of which tightens the nippers on the bulb and releases them when replacing or cleaning the lights. Another cord or a set-screw sets the spring to correspond with the position the light may be in chandelier or wall socket. This angle arrangement works on three sliding ferrules, or round bands, affixed to the spring and tube. The turning of the pole in the operator's hands will unscrew the burnt-out lamp from socket and replace it. Mr. Dunn felt the need of such a contrivance as this while connected with the B. F. Keith's new theater in Boston, where he daily saw the difficulties and dangers of handling lamps at great heights or in out-of-the-way places. Gradually his "manipulator" was developed, and it is now on the market, fully protected by patents. The device is made by the Incandescent Electric Light Manipulator and Cleaner company of Hyde Park, Mass. A well-equipped factory is busy on the many orders received. Electrical supply houses are securing agencies and state rights. In addition to the regular size, Mr. Dunn makes a manipulator for four candle power lamps. This size was successfully employed on the great globe of the General Electric company at the recent Boston convention.

Stanley Green has accepted a position as traveling representative with the Standard Carbon company of Cleveland. Mr. Green will spend his time chiefly in the West, devoting himself exclusively to the carbon business. As is very generally known, Mr. Green was for a long time western manager of Green's Fuel Economizer company. He now enters the carbon business with the good-will of a host of friends, and from his long experience it is safe to assume that he will meet with success in his new connection.

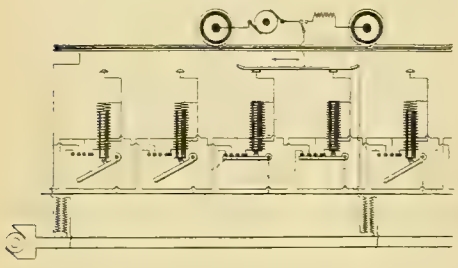
The John Shillito company of Cincinnati, Ohio, owning the largest wholesale and retail dry-goods house in that section, is installing 200 of the Crain Parhelion arc lamps. Mr. George H. Stout, the general sales agent (1208 Sheffield avenue, Chicago) for the Parhelion arc lamp, states that this order was secured wholly on the merit of the lamp; that all competing companies submitted samples and propositions, and that the Parhelion was selected. The simplicity, durability and interchangeability of the Parhelion arc lamp are its salient features.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued September 27, 1898

611,243. Safety Fuse for Electric Circuits. George W. Gardanier, Nyack, N. Y. Application filed December 16, 1897.

The fuse-holder comprising the portions forming an inclosed space between them is combined with the fuse in the space, and means connect the fuse in the electric circuit, the fuse comprising the insulated resistance wire and a soft wire connected with each other, the wire forming the heat coil around the wire.



NO. 611,271

611,258. Truss Frame for Electric Vehicles. Karsten Knudsen, Chicago, Ill. Application filed October 20, 1897.

The frame comprises a pair of forward and a pair of rearward transverse members and a pair of longitudinal members all joined together and lying in a common plane, and a pair of deflected longitudinal members separated from the other longitudinal members by vertical posts.

611,271. Electric Railway. Oscar Preil, Washington, D. C. Application filed December 30, 1897.

An electric railway system comprising a feed-main, separate contact stations, circuit connections for the working current between each contact station and the feed main, each including a single electro-magnet, switching devices controlled by such magnets, whereby the working circuit is made and broken, and circuit connections at each station, controlled by such switching devices, and each connected with the magnet in the working circuit of another station.

611,332. Elevator Safety Attachment. William C. Preston, Providence, R. I. Application filed April 22, 1897.

Four eccentrics are arranged to clamp and hold the starting cord if pulled in either direction; springs close each pair of clamps; an electric magnet held back of each eccentric draws it from the cord when the magnets are energized; and wires to conduct an electric current to the magnets.

611,348. Igniting Device for Gas Engines. William A. Bole and Thomas J. Hogan, Pittsburg, Pa. Application filed June 30, 1897.

An electric igniting device for gas engines comprises a valvular outer casing within which is located a fixed and a movable electrode for making and breaking an electric circuit and thereby effecting ignition of the combustible gases.

611,367. Trolley Pole. Albert M. Meredith, Philadelphia, Pa. Application filed March 31, 1897. Renewed July 16, 1898.

This trolley pole is in sections, and a spring connects the sections and allows the end of one section to roll upon the adjacent section.

611,391. Calipers. Harvey A. Pike, St. Louis, Mo. Application filed September 10, 1897.

An adjustable terminal is arranged on one of a pair of caliper jaws, a fixed terminal arranged on the other, a movable contact for co-operating with both of the terminals, a spring whose normal tendency is to force the movable contact against the fixed terminal, a locking bolt for locking the movable contact against the fixed terminal when the caliper jaws are being adjusted, and means for regulating the compression of the spring, are described.

611,448. Apparatus for Printing Telegraphic Messages. Godfrey M. Gibson, Chulmleigh, England. Application filed November 10, 1896.

One claim is given: The combination of a type wheel, two sets of electro-magnets controlling it, local battery circuits engaging the magnets, contact-makers actuated by the line signals or corresponding punched paper and closing the circuit through the first magnet of one set for a first positive signal and through the first magnet of the other set for a first negative signal, and electro-magnets, whereby each successive signal transfers the circuit of the opposite polarity to the next magnet of its series.

611,460. Electric Arc Lamp. Timothy H. Pettengill, Amsterdam, N. Y. Application filed September 4, 1897.

In an arc-lamp feed mechanism the combination with a rocker or armature and a carbon carrier having a stop of a suspending rod connected to armature and having its upper end extended above the latter in position to engage the stop when the carbon has been consumed, and a carbon-carrier clutch carried by the suspending rod.

611,461. Motor Mounting for Electric Cars. Sidney H. Short, Cleveland, Ohio. Application filed June 26, 1897. Renewed May 19, 1898.

In a motor mounting for electric cars the combination with a multipolar motor and an axle, and gearing connecting the same, the axle arranged to pass within the magnetic ring of the motor field.

611,465. Controller for Electric Motors. Harry P. Davis, Pittsburg, Pa. Application filed April 19, 1898.

One feature claimed is a reversing switch for two electric motors, comprising two movable members, an actuating device therefor, means for locking either or both of the members to the actuating device and for detaching the same therefrom at will, and stationary contacts co-operating with the movable members.

NO. 611,301

611,466. Alternating-current Measuring Instrument. Harry P. Davis, Pittsburg, and Frank Conrad, Wilkinsburg, Pa. Application filed May 7, 1898.

In an electrical measuring instrument there is the combination with the laminated core having an air gap of a primary actuating coil, a secondary coil, a disk armature having radii of different length, an indicating hand or pointer and a spring tending to hold the armature and pointer at the zero position.

611,501. Mechanism for Imparting Successive or Alternating Movements. Elisha Moore, Meductic, Canada. Application filed February 3, 1898.

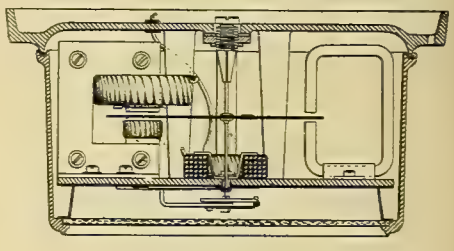
The combination with a shifting member, of a train of alternately operating wheels, dogs co-operating with the wheels, means connecting the dogs with the shifting member and means for operating the whole.

611,558. Apparatus for Starting Motors. James Burke, New York, N. Y. Application filed April 4, 1898.

In this arrangement there are an electric motor, a supply circuit, a local circuit induced from the supply circuit, both of the circuits being connected with the armature of the motor, and an automatic switch adapted to open the induced circuit at an intermediate speed of the motor.

611,559. Electric-railway System. George L. Campbell, Dushore, Pa. Application filed October 29, 1897.

This system comprises a closed conduit, a continuous conductor therein, a conductor composed of short insulated sections forming a part of the conduit wall, a trolley or traveler mounted to traverse the conductor and having brushes adapted to engage both of the conductors, the traveler dropping by gravity to frictionally engage the stationary guide, a conductor connecting the brushes of the traveler, a brake carried by the traveler, and a magnet upon the car adapted to raise the traveler and cause it to traverse the conduit.



NO 611 467.

611,581. Telephone System. Georg Ritter, Stuttgart, Germany. Application filed February 23, 1895. Patented in Germany August 31, 1893; in Sweden August 13, 1894; in France August 18, 1894; in Norway August 20, 1894; in England August 29, 1894; in Belgium September 5, 1894; in Hungary October 17, 1894, and in Austria April 19, 1895.

The system provides for the combination with principal and subordinate line conductors of a call bell in the subordinate line conductor, a branch circuit around the call bell and having one end connected to the subordinate conductor, a contact device connected to the ground, and a switch lever arranged when in one position to connect the line conductors through the call bell, when in its other position to connect the line conductors, through the branch circuit, and when moving from one of the positions to the other to connect the principal line conductor with the ground through the contact device, of telephone apparatus in the branch circuit, a battery at the central station having one pole connected to the ground and the other pole connected to the principal line conductor, and an annunciator in the principal line conductor at the central station.

611,592. Alternating-current Voltmeter. Harry P. Davis, Pittsburg, and Frank Conrad, Wilkinsburg, Pa. Original application filed May 7, 1898. Divided and this application filed June 18, 1898.

In an electrical measuring instrument the combination is described with a closed circuit movable member and means for indicating the extent of its movement against an opposing force, of an actuating magnet and a non-inductive resistance having a low temperature coefficient and connected in series with the main coil of the actuating magnet to compensate for changes in current frequency.

DESIGN.

29,410. Transformer Case. Frederick C. Sutter, Swissvale, Pa. Application filed August 6, 1898. Term of patent, 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, OCTOBER 15, 1898. No. 16

Electrical Decorations at Cincinnati.

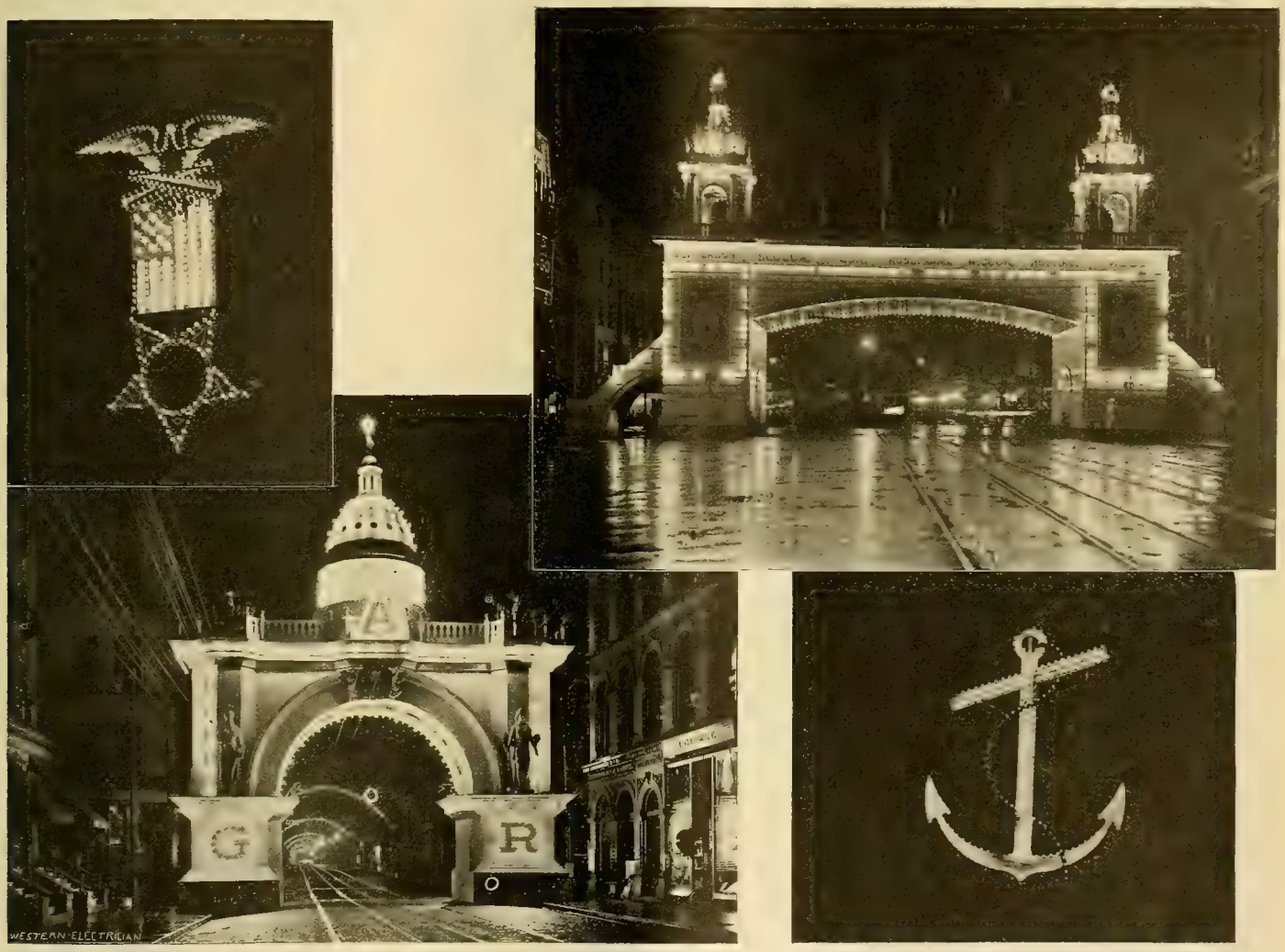
On the occasion of the national encampment of the Grand Army of the Republic in Cincinnati last month the electrical street decorations were effective and in good taste. Two of the illuminated arches and two electrically outlined designs are shown in the picture.

The lower arch, in the group of illustrations, was erected on Fourth street, at the corner of Race street. It was beautifully proportioned and decorated and made a very effective spectacle, especially at night. It was painted white and had the appearance of a marble arch. Incandescent lamps of red, white and blue were liberally studded about the structure. The great letters G A R were outlined in lamps, each letter a different color, and the graceful dome was picked out in colored and white lights. The arch was further ornamented by emblematic statuary and tastefully disposed groups of flags. A fine portrait of Lincoln was given the place of honor at the keystone of the arch. The whole effect was excellent. Beyond the arch will be noticed symmetrical arches of incandescent lights, forming a pleasing perspective down the street. These lamps were supported on iron gas-pipe, bent to the desired shape. The electrical man will also note with some interest the double-trolley wires of Cincinnati passing beneath the arch and the manner in which the overhead wires at the left were taken through the wooden structure of the arch.

Larger and more massive than the Fourth street arch, but not so effective, was the one shown in the upper part of the picture. This was placed in front of the postoffice on Fifth street. It had a wide opening, and when viewed from the east made a beautiful frame for the Tyler Davidson fountain. Hundreds of people viewed the different parades from the top of this arch. The principal decorative features of this arch were the two cupolas, one at each end. These structures were surrounded by figures of soldiers and were brilliantly illuminated. Each cupola was lighted by two arc lamps and a number of incandescent lights. Both sides of the arch were studded with red, white and blue incandescent lamps. The entablature bore the names of a number of Union generals. It is interesting to note that the photograph of this arch, made by L. B. Folger, was taken while it was raining, as the appearance of the roadway suggests.

The badge of the Grand Army of the Republic, shown in the upper left-hand corner of the group, was the striking electrical decoration of a saloon at Fifth and Elm streets. The eagle at the top was outlined in clear-glass lamps, with a ruby eye; the crossed cannon and the cannon-ball were of blue lamps, the cannon-ball being indicated by lamps of larger size; the stars of the flag were clear-glass lamps and the stripes were alternately red and clear; the dependent five-pointed star was shown in amber lamps.

The anchor was a simple but effective decoration adopted by the Cincinnati Edison Electric company. The anchor itself was in clear-glass lamps; the twining rope was of amber-colored lights.



ELECTRICAL DECORATIONS AT CINCINNATI.

Volunteer Signalmen on Furlough.

The New York, District of Columbia and Illinois companies of the Volunteer Signal Corps have been released on furlough until December 4th, when they will reassemble at their armories and probably be mustered out of service. The officers and men who desire to enter the regular establishment under the reorganization of the Signal Corps will be recommended by General Greely and will receive a fair opportunity in the line of appointments.

The three companies mentioned arrived at Washington Barracks from Porto Rico late in September. They had all done brilliant service, for which General Greely, chief signal officer, highly commended them. They had lost few men in the campaign, but a great many had been sick. When they returned to Washington the commanding officer at Washington Barracks was directed, in case of bad weather, to throw open the music hall and allow the men to camp there until further preparations could be made for them. They arrived about 10 o'clock on a damp night, and had a good many sick with them. The commanding officer at the barracks interpreted his instructions technically, and would not open the hall because it was not actually raining. The men were therefore forced to camp out on the wet grounds near by, many of them contracting bad colds, and those already sick being made much worse. The whole battalion suffered great discomfort. The next day, when General Greely was informed of the occurrence, he immediately reported it to the adjutant-general, who gave orders to have the hall opened at once for the reception of the sick until other provision could be made. General Greely was greatly exasperated over the matter, and made a full report to the secretary of war in reference to it. He said that although the commanding officer at the barracks could not be court-martialed, having technically carried out his instructions, he would recommend that the occurrence be counted against his record in the future.

The Chicago members of the Illinois contingent returned home on October 5th. They were heartily welcomed at the station by relatives and a deputation of telegraphers, including operators from the Western Union company and the Associated Press. None of the 26 men in the detachment was ill, but all appeared thin and worn.

Storage Battery on Chicago Alley "L" Railroad.

It is generally accepted as good practice in large street-railway plants nowadays to employ a storage battery for regulating the fluctuations in the load and taking care of the peak during the rush hours. The success which has marked the use of batteries for this purpose on surface roads has attracted the attention of elevated and suburban roads operating under similar conditions and, in the case of the Chicago Alley "L" system, led to the introduction of a large equipment of this character. The battery was placed at two separate points on the line—Sixty-first street and Twelfth street. Each installation comprises 248 cells of 500 kilowatts capacity. The accompanying pictures illustrate the equipment. Fig. 1 shows the battery room at Sixty-first street, while Fig. 2 is a view of the train dispatcher's office, in which the switchboard is placed. The outfit at the other end of the line is practically a duplicate of that at Sixty-first street. The Twelfth street battery room is shown in Fig. 3, and a glimpse of the ticket seller's office, where the switchboard is placed, is presented in Fig. 4. The simplicity of the system could not be better illustrated. The batteries require very little attention, and the train dispatcher and ticket seller look after the switchboards at their respective ends of the line without interfering with their regular duties.

The batteries are in service at all times, charging and discharging alternately, the only regulation being accomplished through two extra feeders extending from the power plant to each battery, to guard against the cells being overtaxed in case of an excessive demand at any time. Thus far there has been no occasion to call upon this means of regulation, but it is anticipated that later in the season, when current will be required for lighting, heating and operating 170 car equipments, the demand at times may be so great that the extra feeders will be called into service.

In order to secure accurate information upon the actual work accomplished by the storage-battery equipment, half-minute readings were taken over a long period by representatives of the railroad company. One of these, which is appended, shows the fluctuations in the load on September 23d, before the batteries were in use, between 5:45 and 6:05 p. m. The other, which is a record taken at the same time of the day on September 26th, shows the result of using the storage battery:

HALF-MINUTE READINGS.

Batteries off.		Batteries on.	
5:45 p. m	6,300 amperes.	5:45 p. m	4,900 amperes.
	4,800 "		4,500 "
	6,200 "		4,800 "
	3,700 "		3,500 "
	6,700 "		5,700 "
	4,500 "		4,300 "
	6,400 "		4,700 "
	7,500 "		5,200 "
	4,800 "		5,100 "
	4,200 "		4,000 "
	6,200 "	5:50 p. m	4,400 "
5:50 p. m	5,100 "		4,900 "
	5,300 "		4,600 "
	5,900 "		3,400 "
	5,500 "		5,400 "
	6,400 "		4,500 "
	5,500 "		3,600 "
	6,800 "		4,500 "
	4,100 "		4,600 "
	5,800 "		5,000 "
	6,000 "	5:55 p. m	4,100 "
5:55 p. m	3,600 "		4,800 "
	6,000 "		4,400 "
	6,200 "		4,600 "
	3,500 "		5,000 "
	6,400 "		3,800 "
	6,400 "		4,300 "
	4,500 "		5,500 "
	5,100 "		4,600 "
	6,700 "		4,300 "
	4,700 "	6:00 p. m	4,900 "
6:00 p. m	3,000 "		4,400 "
	5,800 "		4,300 "
	7,000 "		3,900 "
	4,700 "		4,600 "
	6,200 "		3,800 "
	4,700 "		4,100 "
	3,900 "		4,300 "
	4,000 "		4,500 "
	5,500 "		4,500 "
	5,000 "	6:05 p. m	3,300 "
6:05 p. m	3,700 "		

It will be noticed that, with the storage batteries in use, the widest fluctuations were from 5,700 to 3,300 amperes, while the demand before the batteries were employed varied from 7,500 to 1,700. In one case there was a change recorded from 7,000 to 1,700 and back again to 6,200. In such service it will be readily understood that a storage battery must prove a valuable auxiliary to the regular power equipment.

The installation was made by the Electric Storage Battery company of Philadelphia, of which F. H. Clark is the Chicago representative. Sargent & Lundy were the consulting engineers for the railroad company.

Electric Railway for Porto Rico.

American occupation of the annexed or protected islands will bring American improvements. For instance, it is already reported that George Keck, George Willets and Allan Reid of Chicago, representing an American syndicate, have purchased the railway line running from the center of San Juan through the only suburb to the village of Rio Piedras, seven miles distant. The line is now operated by steam, but electricity will soon be substituted. Land concessions in connection with this short railway line have been secured by the same syndicate, which is also considering similar projects.

To What Extent Should Street Railways Engage in the Amusement Business?[1]

BY WALTON H HOLMES.

PART I.

When I consented to prepare a paper for this convention on the subject selected for me by the excutive committee, I did so with great reluctance, knowing full well that the conditions in the numerous cities where street railways are an important public agency are so widely different as to present

FIG. 2. STORAGE BATTERY ON CHICAGO ALLEY "L" RAILROAD—SWITCHBOARD IN TRAIN DISPATCHER'S OFFICE.

a different problem in almost every instance, and, except from a very broad view of the subject, to render comparisons altogether impossible. But in spite of these inherent difficulties, I feel that some general principles may be extracted from street-railway experience which may be advantageously employed in correctly solving a problem which must arise in nearly every locality where street railways exist. I have not hesitated to ask for the experience of others, and I beg to acknowledge, at the outset, the many valuable responses which I have received from street-railway managers for whose judgment I entertain the highest respect.

Street railways are peculiarly an urban agency. They were born of the wants and convenience of a city population, and the development and growth of travel are so closely associated with the growth and prosperity of the municipality that street-railway managers can never be too zealous and active in every public enterprise which is designed and well calculated to stimulate municipal expansion and civic pride among the citizens. This is notably an age of progress in every line and in all directions. The ideal city of a few years ago is no longer considered adequate in its appointments for the welfare of its inhabitants. Every up-to-date city in the land has come to acknowledge that it owes a larger duty to those who live within its boundaries than merely to afford police and fire protection. The comfort and pleasure of its inhabitants must now also be considered and looked after, and this tendency and demand of the age have crystallized and taken form in providing parks and squares for the comfort, pleasure and entertainment of the great body of the people, and drives and boulevards for those who are more favored in the distribution of worldly goods. These public pleasure resorts are an important factor in the question under discussion. Wherever established, they are preferred by the people, who justly regard themselves as proprietors, and hence it is that many street-railway companies which undertook to supply an obvious public want in this direction a few years ago have found this particular occupation gone, and only a small number of the important systems of the country any longer maintain these parks. The demand has regulated the supply.

But the street railways have a great and peculiar interest in these public parks. It is our mission, as a public agency, to render them as accessible and useful to the people as possible; and to this end it must be apparent that by a reasonable expenditure of money toward the amusement and entertainment of the people in their own resorts, street-railway travel can be stimulated and the health and welfare of the community greatly promoted at the same time. Results are more easily obtained by encouraging a natural tendency of the kind referred to than by efforts to entirely create business through independent and artificial means. With rare exceptions, commissioners of these public parks look upon them as the inheritance of the people and regard it as a solemn duty to encourage the efforts of the street railways to render them as accessible and pleasant for the inhabitants as possible, and are only too glad to have their own endeavors in the same direction supplemented by the street railways.

Public parks are usually numerous and scattered in different localities, and in this lies a great advantage to the street railway over the maintenance of a private resort of its own. In one case travel becomes congested, with the increased danger of accidents and maintenance of a surplus amount of idle equipment for a large portion of the year, while in the other public patronage is more generally distributed where it naturally belongs and serves to keep better employed the standard equipment of the line without much additional expense or risk.

With reference to parks and similar resorts, I therefore think it may fairly be deduced that street railways have generally found their maintenance on private account to be ill-advised and unprofitable except in a few places where locations are such as to warrant more than the ordinary five-cent fare, and that the best results are to be secured by intelligent aid of the public municipal authorities in their efforts to render their own resorts attractive, pleasant and entertaining to the great body of the people. The same thing is obviously true with reference to large buildings of a quasi-public character intended to afford accommodations and facilities for conventions, entertainments and exhibitions on a large scale. In my judgment, such enterprises,

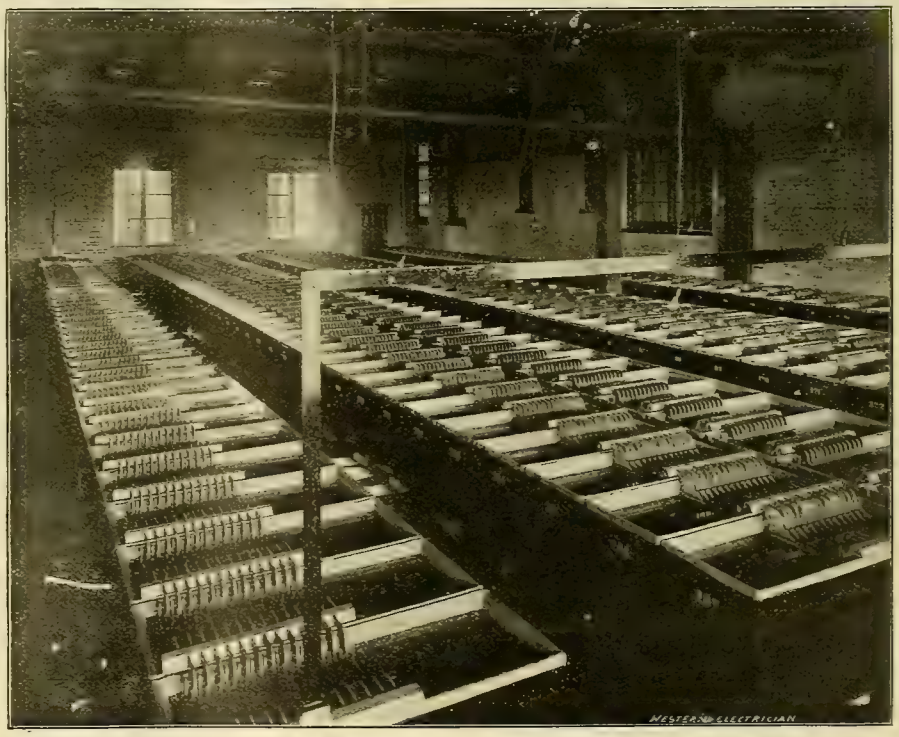


FIG. 1. STORAGE BATTERY ON CHICAGO ALLEY "L" RAILROAD.—BATTERY ROOM AT SIXTY-FIRST STREET.

1. Read before the American Street Railway association, at Boston, September, 1898.

when judiciously conceived and undertaken, may well receive substantial encouragement from street railways to an extent which would warrant representation being accorded to them on the board of managers. I consider such representation important in the interest of the public as well as of the street railway, because both have an apparent and common interest in keeping the price of admission to such buildings down to a figure which will keep them always popular in fact as well as in name and stimulate travel on the street railroad.

Street railways have seldom undertaken to foster other than out-of-door amusements, and these are always attended by the risk of bad or unseasonable

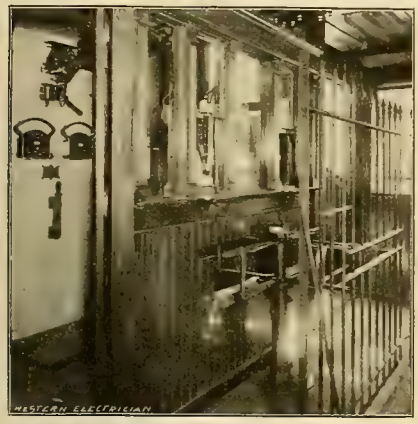


FIG 4. STORAGE BATTERY ON CHICAGO ALLEY "L" RAILROAD.—SWITCHBOARD AT TWELFTH STREET IN TICKET-SELLER'S OFFICE.

weather and the like, which frequently entails heavy loss. Cars must be accumulated in large numbers where such attractions are being presented, in order to take the people away at the proper time, thus greatly increasing the cost of car service and sometimes necessarily retarding the tide of regular travel at other places, with the attendant loss. Such enterprises frequently engross much valuable time of the chief managing officers which would otherwise be expended in other directions. These and kindred considerations, which will readily occur to the experienced railway manager, are very potent reasons why the companies should not themselves engage in the amusement business. Many of these things are impossible to estimate in dollars and cents, and so it is that street railways are every day coming to realize, more and more forcibly, that the business to be relied on for profits is that which follows the natural channels and can be handled in the usual and ordinary way.

I need hardly say that some of our large cities have reached a point where the ideas advanced in this paper have no practical application. With some of them the problem is not how to create or stimulate travel, but rather how to best handle and take care of the patronage which is already at hand. Then, again, there are many small cities which have not yet attained to that important rank which justifies the public authorities in undertaking to provide for the pleasure and amusement of the people at large. Street railways thus located have frequently found it profitable in a degree to supply this want on their own account, and to them the views here presented are likewise of little practical importance. I have considered more particularly that large class of cities which occupies the middle ground between these two extremes, and where it has seemed to me there is opportunity for the profitable and practical application of sound principles of street-railway management in the particular under consideration.

Where amusements are to be provided or encouraged at all, general experience shows that there is little or no difference of opinion as to the character of entertainment which ought to be furnished. The view entertained is well-nigh universal that expenditures in this behalf should be moderate in amount. The best and most satisfactory results have generally been obtained from such attractions as novelties in the way of music, like noted bands or other musical combinations, vaudeville, athletic sports, baseball, where the city is large enough to have membership in an important league and to support a first-class club, football and other out-of-door entertainments.

In many of the southern and western cities visitors are few and business comparatively dull in the summer season, with much of the resident population sojourning at the seaside or in the mountains; and half-holidays with business houses generally closed are by no means infrequent. This condition means light travel on street railways unless some inducement outside of the ordinary is offered to those who have remained at home. Amusements and entertainments of the kind to which I have referred have been found to be well adapted to this purpose, and in many instances have proved to be undoubtedly profitable to the street railway.

It has occurred to me that perhaps I may be expected to say something of my personal experience, extending over a period of many years, leaving my intelligent hearers to make such application of the same to their own conditions and environment as to them may seem advisable. During my service as a street-railroad man, Kansas City, where I have always operated, has grown from a city of 30,000 to upwards of 200,000 inhabitants, and consequently opportunities have been afforded me of viewing the business in a number of varying stages of its evolution.

In the early days we began in a modest way by providing a small natural park with music and attractions which were not very expensive. As the city grew and lines were extended, both urban and suburban, we established and maintained for a number of years two high-class and well-improved parks, one being located within the city boundaries, where it could be reached for a fare of five cents, and the other on a suburban connecting line, where the round-trip fare was 15 cents in addition to the street-car fare. At both of these parks flowers were extensively cultivated and displayed and amusements of many kinds were furnished, such as bathing beach, boating, dancing, vaudeville, music, light opera, balloon ascensions and the like. No charge was ever made for any of these except for the use of bathing suits and boats and a small admission fee to the light opera. In the way of music, we have furnished some of the most famous bands which have visited this country and have frequently engaged such distinguished artists as Signor Liberati and his band for weeks at a time. We have found the public taste in such matters capricious, demanding a frequent change of programme, and, as time has passed, a higher order of entertainment. On the whole our efforts have been appreciated and the patronage has been generous, but it is difficult to say whether the profits have been sufficient to justify the immense amount of energy exerted in this direction, and we have finally altogether abandoned the maintenance of any such places by the company. Two parks, one city and the other suburban, are still maintained by independent corporations, at which, outside of boating, bathing, etc., music has been the only attraction furnished the present season, except a summer opera, for entrance to which a small admission was charged. We pay these park corporations a stipulated sum for furnishing our patrons with the free privileges of the parks. Meantime Kansas City has begun establishing its own public parks, and as they become sufficiently improved to be generally used, it will be the policy of our company to encourage their use by the people in every reasonable and legitimate way.

We have always given liberal financial support and encouragement to the maintenance of a professional baseball club, and have always found the returns from this source satisfactory and I believe profitable.

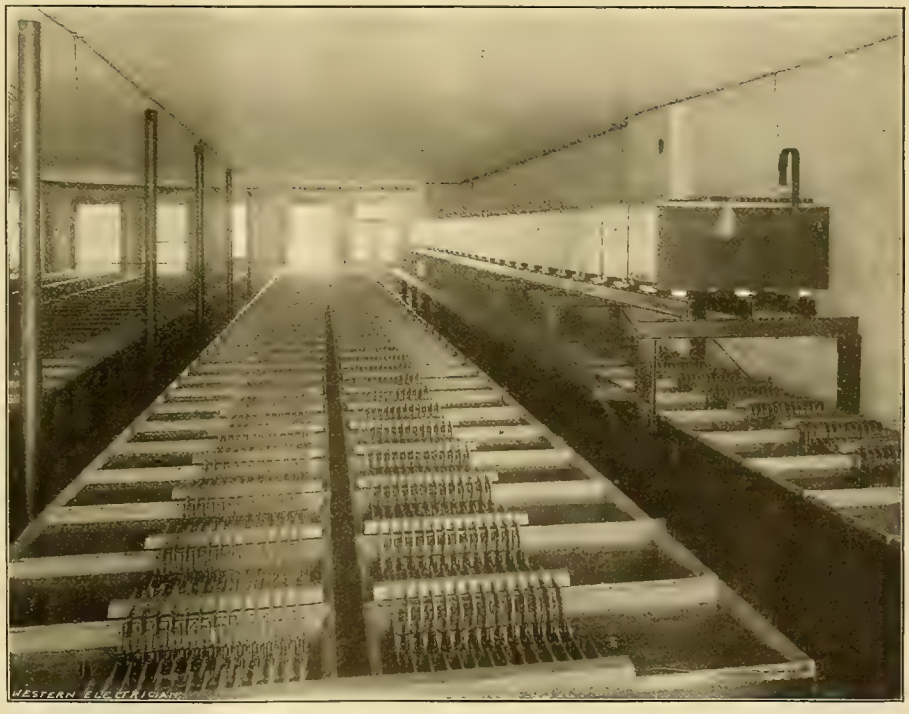


FIG 3. STORAGE BATTERY ON CHICAGO ALLEY "L" RAILROAD.—BATTERY ROOM AT TWELFTH STREET.

Our company has given liberal financial aid and encouragement to the fall festivities which are of annual occurrence at Kansas City. They consist of a night parade by a local organization known as the "Priests of Pallas," representing, by a series of fantastic floats, scenes from history or mythology, a flower parade and a grotesque carnival parade in the daytime on successive days, under the auspices of the "Kansas City Karnival Krewe." In these parades many brass bands from the section of country tributary to Kansas City are employed to take part. The festivities extend over a period of several days, and are the means of assembling a large concourse of strangers in Kansas City. They are universally regarded as bringing much trade and business to the city, and I am confident our company makes no investment in the way of amusement and entertainment to the public which brings better returns.

A noted military chieftain (General Hancock) spoke of the tariff question as a local issue, and such, in a large measure, I have found the subject assigned me for this paper, and I can only hope that something of what I have said may prove to be of local use to many of you.

Discussion.

C. D. Wyman, New Orleans: I have always believed that a street-railroad man should stick very closely to his line of work, and that he has very little freedom or time for going into the amusement business or any other sort of business that is not intimately connected with the daily operation of his cars, the management of his power plant and that style of business and methods that pertain specially and particularly to the working of his road. Therefore, I have always said, "Keep out of it; don't go into the establishment of parks and the engagement of actors and actresses, musicians and all that sort of thing; do not establish skating rinks. Let someone else in the dramatic line do it. If you do it at all, lease it out to him; encourage him in some way, but do not manage it yourself or try to run it."

I have discovered, however, that, as Mr. Holmes very truly says, local conditions affect this matter to a very large extent. I have also discovered the truth of the old adage that if you want a thing done well you have to do it yourself, and my experience with the persons who are engaged in the purveying of public amusements to the people is that they are not altogether the most reliable agents in the world, and that it is good policy, if you want to establish amusements upon that line, to take them under your own control and management.

I have also found in a great number of cities where I have had both official and friendly relations with the company and its representatives that this promoting of amusement enterprises was a very good method of stimulating the business of the company. Mr. Holmes very rightly said that it was a proper thing for the street-railway companies to aid in the development of municipal improvements, like public parks, and on that score there is a philanthropic and humanitarian work which we can do, especially during the summer season, for it is true that the universal custom in almost all cities is to close the theaters and places of amusement during the summer, when the wealthier classes of people, to a large extent, leave the city for summer resorts, and the other class, the class from which we derive the major portion of our income, is left without amusements and healthful entertainment and pleasant outing resorts.

Further, it has been customary in some cities in hot weather for people not to go out much in the afternoon and the evening; in the southern cities this is particularly true. In the evening they visit from door to door, neighbor to neighbor, sitting on the galleries, as we call them, and getting cool without circulating about very much. Now we of the southern land having been trying to replace this practice with what we thought was better for them and incidentally for us, and we have provided places of amusement with music and other attractions, and travel has been greatly increased. Therefore, upon

that line, wherever a habit of insularity on the part of the people exists, these amusement resorts, if well conducted, clean and pure in all their surroundings, and in what is presented, will surely cultivate travel.

Now, so far as the congestion of travel which Mr. Holmes speaks of on any particular line is concerned, I do not think that I fear that to a great extent. We are always willing to have a good deal of congestion in running a street railroad. It is always to be remembered that if a resort at the end of some particular line shall, for the time being, congest the travel upon that line, in a great many instances we use that line as a feeder to the others. In one city with which I am familiar there is one line at the terminus of which is a resort of this character; but while the cars are leaving at a minute or half-minute, and sometimes 20 seconds' headway, upon that line, when they reach the central part of the city the people immediately disperse to the other lines, and the other lines get a large benefit therefrom. Fortunately the transfer system is not so extensively used as to preclude the other lines from getting some revenue. So that I think very often the congestion which was suggested as being possibly injurious is not so harmful as one might think.

One thing we must always remember, and that is that street-railroad riding is, after all, a habit. As a habit it is growing. We can look back a few years when general riding was not so usual, when people walked a little more than they do now, when we sent our messages, not by telephone, but by a messenger who walked. Now all these different improvements that we are introducing in the way of finer cars, of higher speed, of better facilities, and

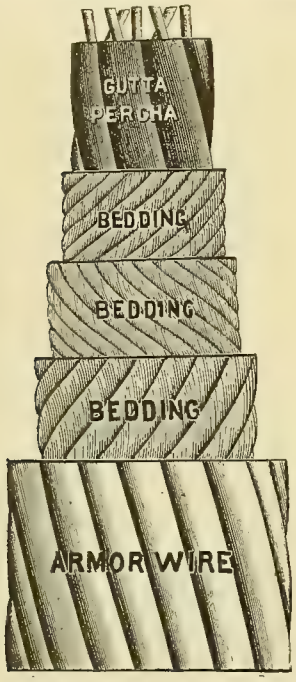


FIG. 1. THE USE OF ELECTRICITY IN THE SPANISH-AMERICAN WAR.—SEVEN-CONDUCTOR TORPEDO CABLE.

last of all, amusements, means a constant tendency to increase the habit of street-car riding, and I believe that anything that has that trend is certainly very beneficial.

Mr. Davis, Williamsport: Do any of the roads represented here keep their statistics concerning their amusement business separate from their general business, showing exactly the amount of travel due to the amusement feature of their business? The experience in Pennsylvania, among the small parks, is that the profits derived from the amusement business is not in proportion to the risk of the money spent, and in quite a majority of places the rule is that it is almost impossible for the manager to separate the hot-weather travel on amusement lines from the travel due to the entertainments or park itself.

Mr. Holmes, Kansas City: I will say that as far as Kansas City is concerned, where we have the out-of-town parks, we have kept careful records of the business, because we sell tickets to the park, and I would be glad to talk that over with anybody or send him information. I recently received a letter from Mr. Goodrich of Minneapolis, who has had a great deal of experience in the railroad business, and especially in the matter of parks. At Lake Harriet they have a nice pavilion, and they are relieved of the expense of maintaining the park entirely, and Mr. Goodrich is firmly of the opinion that it does not pay their company to employ a band of music or any other attraction for that park. I can easily understand why it would not, because in our northern cities, and Kansas City is almost one, as compared with New Orleans, our summer season only lasts probably two and a half months, and we are compelled to depend upon the weather for our business. If the nights are cool, travel is very light.

[*Continued on page 222.*]

The Use of Electricity in the Spanish-American War.[1]

By Thomas G. Grier.

The application of electricity in the army and navy for various purposes is recent, but its progress has been rapid. The object of this paper is more to note the uses than to describe the details.

The fortification board established 10 years ago by the United States government has developed complete and elaborate plans for the equipment of coast fortifications.

In these plans electricity plays a very important part. Submarine mines connected by cable with harbor forts have been planted; electric-light and power stations have been installed; searchlights, motors, telephones, telegraph instruments and many other devices have been used in preparing for the defense of our harbors.

Range finders for determining distances were extensively used. These instruments may be dependent upon electricity for their operation, as in the case of the Fiske range finder, or may be operated mechanically.

Just prior to our recent war with Spain 200 Lewis depression range finders were ordered by the United States government to equip our various fortifications. While these instruments are operated mechanically, their efficiency in action depends upon the application of electricity in communicating the distance observed to the gun captain or commander.

To condense as much as possible, a brief summary of the applications can be given by describing the methods employed at Fort Wadsworth, which lies just below New York city. In this fort the fire commander directs the attack from a sheltered station, equipped with a Lewis range finder. There is also a position-finder station and four battery-commander stations. The fire commander is in direct communication with all by means of telephones.

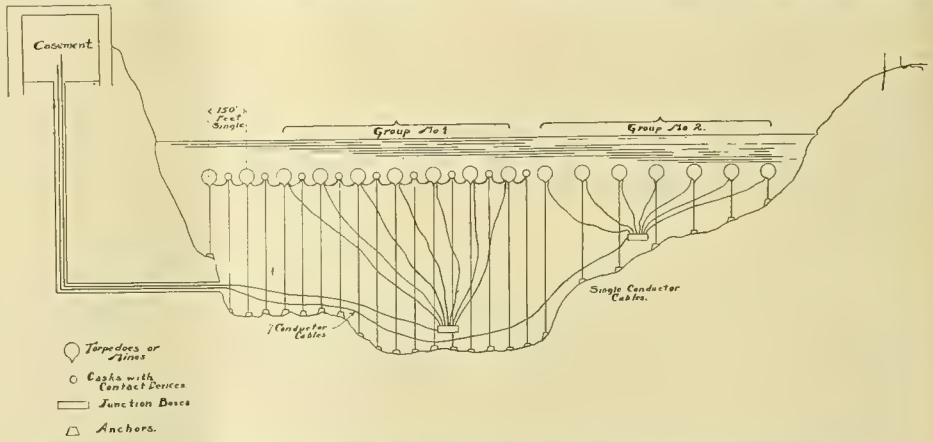


FIG. 2. THE USE OF ELECTRICITY IN THE SPANISH-AMERICAN WAR.—PLAN OF MINES IN BOSTON HARBOR.

In the position finder's station, together with numerous other instruments, is a dial-telegraph electric clock and telephone. One of the guns is equipped with a dial telegraph and another with a Sheey teleotype, an instrument which indicates the azimuth or angle from a predetermined line and gives the range or distance in yards of the observed vessel from the fort.

All of the commanders' stations are, however, connected with the guns, both by speaking tubes and telephones.

Observations are signaled to the guns, and the course and speed of a ship are plotted upon a miniature representation of the harbor. By means of an electric clock, placed at every station, absolute uniformity of time is obtained, and the probable course and range of a vessel for several minutes can be plotted from these observations, and without even seeing the vessel the gun can be elevated for the range and trained for the proper angle, and by means of a stop watch the order to fire given so that the shot will fall upon the deck of a vessel whose course has been observed by men at a distance from the guns. The introduction of electricity for signaling has given this wonderful control to the fire commander over his batteries.

Sandy Hook, at the mouth of the harbor, is connected by cable with Fort Wadsworth, and the approach of hostile ships may be telegraphed to the fire commander so that their course may be watched and the fort prepared at the proper time to do justice to the work before them.

Sandy Hook was placed in telephone communication also with Washington during this summer, so that the government was in position to receive or send messages to the fortifications.

Fort Wadsworth has two 60,000 candle power searchlights to sweep the harbor and guard against the approach of vessels on dark and stormy nights.

An electric-light and power plant forms a portion of the outfit, with a reserve storage battery to supplement the power station.

The channel above the fort is mined, and should some of the vessels of a hostile fleet pass the guns of the fort, the observers at the submarine station would be plotting the course of nearby ships, by means of range finders or by information furnished them by the fort, and, at the proper time, fire the mine and sink the remnant of the fleet.

The mining of the harbors was an important part of our coast defenses, and the greatest demand for electrical wires and cables was for "torpedo cables" for use in submarine mines. It seems that our coast-defense department has for years requested that an appropriation be made for cable, but the appropriations have been so cut down that not more than five per cent. of the amount needed was carried on hand by the government. There are two styles of cables used—a multiple cable of seven conductors, which is used to connect the shore end to a junction box in the channel, and a single-conductor cable which connects each conductor in the multiple cable to an independent mine, each conductor being numbered. Any mine may be exploded at will from the shore.

When war was declared each of the manufacturers of submarine cable in this country received orders for all he could make in 30 days, and some were kept busy for 60 days, producing, probably, 200 miles of multiple cable and 200 miles of the single conductor. This has been distributed from the Bay of Fundy to Florida. Some were sent to the Gulf cities and some to California, Oregon and Washington. One hundred and fifty miles of each size was under contract in the early part of August. The cost of seven-conductor cable averages about $1,900 per mile, and the single-conductor about $450 per mile.

Headquarters for work on submarine mines are at "Torpedo Station," Willets Point, Tory Island, with Major John D. Wright in charge.

In preference to any description of the cables showing the construction, a picture (Fig. 1) of the seven-conductor cable, as made by the Bishop Guttapercha company of New York, is given, and samples cut from cables shipped to the government by the Bishop Guttapercha company of New York, the Anchor Electric company of Boston, the Simplex Electrical company of Boston and the Standard Underground Cable company of Pittsburg have been secured.

Submarine Mines.

There are three different kinds of mines used in our harbor defense.

First—Observation mines, which are fired from shore when a ship is judged, by observation, to be within effective range of the explosive.

Second—Automatic mines, which are self-firing on being struck by a vessel.

Third—Electrical contact mines, which, on being struck by a ship, give notice on shore, and the operator, by the throw of a switch, fires the mines.

The methods of firing observation mines and electrical-contact mines are similar. Automatic mines may or may not be fired by electrical means.

Mines may be placed upon the bottom of the harbor, and in such cases are called ground mines, and if they are contact mines the contact mechanism is contained in small buoys anchored at a depth below low-water mark just sufficient for them to be an obstruction in the path of vessels. When the channel is deep, buoyant or floating mines are used. A buoyant mine is more effective, as it lies nearer the object of attack, and for an equal effect does not require as large a charge of explosive.

The shape and material of mines or mine cases are various, and the kinds employed at different points are not always identical. However, a general description of the mines employed in Boston Harbor will give a good idea of the plan and design used in all other harbors.

Mines in Boston Harbor.

There were about 1,000 mines planted in Boston Harbor, covering the main ship channel and ingress to the harbor where vessels of over 12-foot draft could go at low water. The regular government mine consists of an upright iron cylinder about the shape of a top, with a strap on the bottom for holding the cable. Galvanized steel rope secured by an anchorage of any kind, and in many cases of old horse-car rails, maintained the mines in position. The cable containing the electric wires runs up separately from the cable holding down the mines.

As the demand was urgent and no mines of the government pattern were to be had, the engineers in Boston used new ale barrels, a hole being bored

1. Read before the Chicago Electrical association, October 7, 1898.

in one end for the receipt of the contact mechanism and cable. The barrels were encircled with rope to make a sling to hold them down, a flat steel ring put around the rope so that the steel anchor cable attached to it would not cut through. These mines were of different sizes, and held from 100 to 500 pounds of explosive gelatin. Ordinary dynamite was used in some mines, where there was not enough gelatin to be obtained. This was put in through a small hole in the top, where the electric-contact mechanism is placed.

The contact mechanism is connected through high resistance and by a battery circuit, using the cable and ground return for its conductors, to an indicating and circuit-closing device located in the protected casement on shore. When a ship strikes a mine containing the device, deflecting the mine from its normal position, the battery circuit is closed; this operates an indicating mechanism which closes a break in the dynamo circuit and notifies the operator. To throw on the current for exploding a mine it is necessary to throw in a switch or plug after the first break is closed by the indicating device. This circuit can be closed without any contact from the vessel, at the will of the officer in the casement.

The firing switchboards at Boston consisted of an ordinary knife switch suitable to take 500 volts, with a spring which holds it out of contact at all times except when kept in position by the operator. These switches, one for every group of mines, were mounted on slate boards and plainly numbered with large letters. A dynamo developing one ampere at 500 volts, driven by an oil engine, furnished the exploding current.

The contact devices were made part by the Anchor Electric company and part by the General Electric company, the design being that of the government with several alterations made by Dr. Louis Bell, the engineer in charge for the government, to shorten the time of manufacture. All of the parts of the contacting mechanism were of platinum or gold-plated brass to prevent any possibility of corrosion. The exploder consisted of a thin strip of platinum wire which was laid in a case of fulminate, which in turn was put in a case of dry guncotton; the remainder of the explosive was wet.

The mines were usually placed in groups of seven each, about 150 feet apart. (The plan is shown in diagram in Fig. 2). These groups of mines in Boston Harbor were strung clear across the channel, and in the main channel there were three lines.

In this method, should a vessel be sunk by the first line of mines and the wreck not obstruct the passage for other vessels, the second line of mines would catch the next vessel and the third line the third vessel. Between the mines were small casks with contacting devices connected to mines on either side. These were cheaper than mines but were equally serviceable and made the line complete, so that no vessel could get through.

Various Applications

The submarine cables connecting the world's centers of humanity—a great system of electric nerves—had a most important influence in every feature of this war. Ships at distant points were enabled to advise and receive information, and movements of fleets could be directed from the seats of government. It is hard to conceive of this almost complete annihilation of time and space.

The Oregon, that speedy and modern man-of-war, equipped with powerful machinery, took 81 days to make the remarkable voyage from Puget Sound to Key West, a distance of about 18,000 statute miles, and of this time she was about 59 days at sea. The distance by cable and telegraph from Chicago to Hongkong is nearly as great, yet to send a message between these two points, including all the delays caused in the many transfers, requires less time in minutes than it took the Oregon days to make the trip.

Our army in the field has its cable tents completely equipped with telephones and telegraph instruments. The telephone at Santiago and adjacent points before and after the siege was of great service, and cable tents now have their names lengthened into the title of cable and telephone tents.

The Bishop Guttapercha company of New York has furnished the government with a special cable, which is used in the signal service by General Greely. It is very light and very strong, weighs about 60 pounds to the mile, and is furnished on reels in half-mile lengths—a two-conductor concentric cable. This outpost cable, as it is called, is carried by a scout on a reel fastened to his back like a knapsack. He carries a telephone, and one end of the cable being connected at headquarters, enables him to communicate in whispers to his commander. An attendant accompanies the scout with extra reels, which are easily attached when the wire on the first reel has reached its limit. Telephones, in fact, are used everywhere—in forts, in camps, in the field, and on board vessels.

Among the most recent applications of electricity that found a place in the army and navy was the X-ray apparatus. It was used in the field, in the hospitals and on the hospital ships. The Solace was equipped with the latest production of the Edison Manufacturing company.

Notices were published in the papers of electric cooking outfits, which were going to be placed upon some of the hospital ships, and if it was done there is no doubt that much comfort and convenience resulted, especially when the vessels were in the warm climate of the West Indies.

Aboard modern men-of-war the electric light is found to be absolutely necessary for the efficiency of the ship. Searchlights are used to observe the movements of other vessels, to find buoys or landmarks on entering shallow channels, to pick up disabled boats or men overboard, to make landings, and for signaling. The incandescent lamps illuminate the entire ship, dispensing with oil lamps and candles; they are also used for night signaling.

Electric motors are used in hoisting boats and ammunition, for removing ashes, for steering, for training gun turrets and many other purposes.

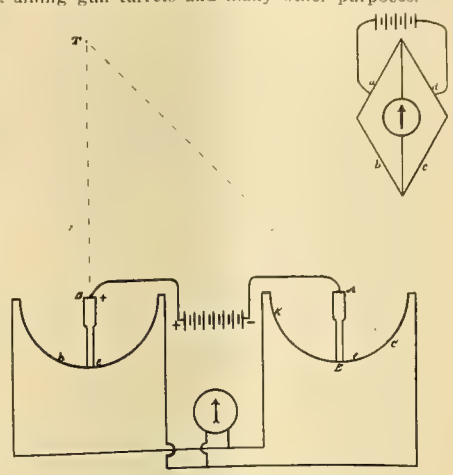


FIG 5. THE USE OF ELECTRICITY IN THE SPANISH-AMERICAN WAR.—PRINCIPLE OF OPERATION OF FISKE RANGE FINDER.

Steam whistles are opened and closed by electrically operated valves.

The range for guns and the speed and direction of revolving shafts is determined by the electric current, and guns are fired by an electric spark.

Telephones and electric signaling devices aboard ship are extensively used.

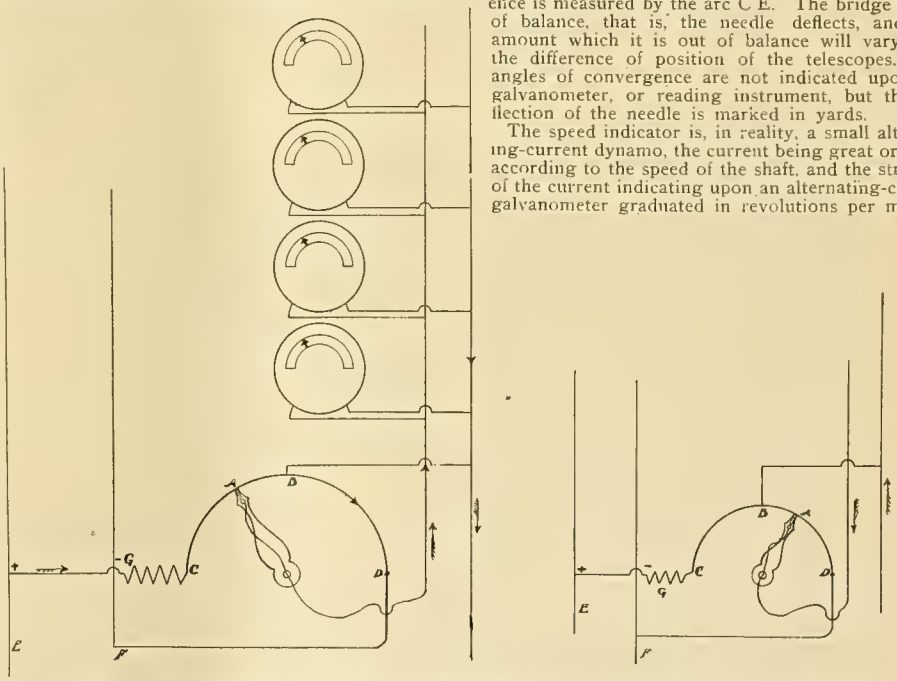
This, in brief, covers the application of electricity ashore and afloat in the recent Spanish-American war.

Signaling Devices.

A description of the principles governing some of the signaling devices on board ship will materially assist in showing to what a great extent modern vessels depend up on electricity.

The signaling and indicating devices used on vessels are: "Helm indicators," "steering telegraphers," "speed indicator," "direction indicator," "range indicating system," "Fiske range finder," "azimuth telegraph" and "transmitter of orders." All of the devices consist of galvanometers, which indicate on their dials a difference of pressure, the dials being marked for the different offices the instruments perform, and with each instrument or system of instruments proper devices are used for altering resistances, and consequently changing pressures to accomplish the ends in view. A description of the principle applied to the helm indicator will explain the operation in general of all the others.

The object of the helm indicator is to indicate, at different parts of the ship, the position of the helm. The principle of operation is shown in Fig. 3. Attached to the helm and insulated from it is a metallic contact A which presses continually on an arc of resistance wire C D. At the center of this resistance wire is a permanent contact B which is connected by a wire to one side of a number of galvanometers located at various stations. E and F are the negative and positive wires of the electric-lighting system. Primary or storage batteries also could be used as the source of energy. A dead resistance is inserted in the circuit connected with the arc of resistance wire C D, which reduces the current to about two amperes.



FIGS. 3 AND 4 THE USE OF ELECTRICITY IN THE SPANISH-AMERICAN WAR.—PRINCIPLE OF OPERATION OF HELM INDICATOR.

The current flows as indicated by the arrows. As the pointer A is moved toward the left, or toward C, the difference of pressure between A and B becomes greater, and the flow of current through the galvanometer is greater. The galvanometers are adjusted so that they take the same angle as the helm, or pointer A. In Fig. 3, when the pointer is on the left of B, its pressure, as compared with B, is positive. When B and A are both in the center, or when the pointer A coincides with the fixed point of contact B, then the needles of the galvanometers come to rest at zero, or the center of the scale. When A is moved toward the right, or toward D, then the conditions are reversed (Fig. 4), A becomes negative, compared with B, and the current flows in the opposite direction in the galvanometer, bringing the needle toward the right. One of the instruments can be on the bridge, one in the captain's cabin, one in the wheelhouse and one in the conning tower.

The steering telegraph is the same arrangement of galvanometers, with a device for altering the resistance by hand. The captain sets the resistance from his station, having an instrument before him. The same indication appears upon an instrument in the wheelhouse, and by noting the helm indicator the captain is advised when his order is obeyed. The same thing is true of the engine telegraph, the transmitter for orders and the azimuth telegraph.

In the Fiske range finder the general principle is the measurement of the resistance of a conductor in the form of a Wheatstone bridge, there being two arcs of wire at the ends of a base line, corresponding to two contiguous members of the bridge. Two telescopes are located at the ends of the base line and carry contacts which move over the resistance wire as the telescopes are turned to be pointed upon any object.

In Fig. 5, let the arms a b of a Wheatstone bridge be represented by arc h, while c and d are bent into arc k, both of these arcs being wires of conducting material. Let contacts e and f be attached to telescopes pivoted at A and B. When the telescopes are parallel and when at right angles to the base line, the galvanometer will not deflect and its point of rest is marked infinity. Now, let the telescopes converge, and the angle of convergence is A T B, and, presuming, the telescope at B is pointing at right angles to the base line, the angle of convergence is measured by the arc C E. The bridge is out of balance, that is, the needle deflects, and the amount which it is out of balance will vary with the difference of position of the telescopes. The angles of convergence are not indicated upon the galvanometer, or reading instrument, but the deflection of the needle is marked in yards.

The speed indicator is, in reality, a small alternating-current dynamo, the current being great or small according to the speed of the shaft, and the strength of the current indicating upon an alternating-current galvanometer graduated in revolutions per minute. Six soft iron cores or inductors, fastened to an iron ring on the shaft, form the armature. These are rotated, the pole of a north and south magnet having two coils of wire at its extremities, the coils of wire being connected in series with the galvanometer.

The direction indicator simply tells in which direction the shaft is turning. A permanent magnet fastened to a ring on the shaft revolves in front of a soft iron bar, around which is a coil of wire that is connected to a galvanometer. The shaft revolving in one direction throws the pointer to one side, and when its direction is reversed throws it to the other side.

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One of the requirements of the American forces in Cuba will be additional facilities for communicating between the several points at which troops will be stationed. Preparations are being made to send a large number of engineers to the island very soon. There is immediate need also of several companies of the Signal Corps, and General Lawton has sent a cable message to the department urging that another signal company be sent to Santiago province at once. There is at present neither telegraphic nor telephonic communication between Santiago city and the points on the northern coast of the province which have been garrisoned by American troops, and the only practicable means of communication is by sending a ship around the eastern end of the island. The military occupation of Cuba by the United States will bring to the island the benefits of the telegraph and telephone, which it has sadly needed.

In the preparations for the Peace Jubilee in Chicago next week provision has been made for a general illumination of the thoroughfares through which the night parade will pass and for special decorative features in which incandescent lamps will play an important part. No public demonstration of any magnitude is considered complete nowadays without an abundant use of electricity for illumination, and the employment of signs and devices of special design for such occasions has developed a distinctive branch of electric lighting to supply this demand. Chicago will probably witness some striking spectacular effects in the electric illumination next week. The importance of this city as an electrical center should insure a fair representation of the industry in the preparations for this patriotic celebration.

It is said that thieves have found a new avenue for their undesirable activity in the stealing of incandescent lamps from exposed places in front of business houses, theaters or other buildings where the lights are used in signs or for display. Of course most of such lamps are in places not easily accessible, but there are some, about doors and show windows, within the reach of the passer-by. An obvious protection is to remove the lamps and put them in a place of safety over night. Another is to place a strong screen over the sign or decoration which may be rifled, but this plan has the decided disadvantage of obscuring the light and disfiguring the design. No doubt, if the annoyance continues, some modified form of socket or a cheap and easily attached protective device will be invented to foil the evil intention of the despoiler.

If the interpretation of the corporation counsel of the city of Chicago be accepted, the ordinance granting the Chicago Telephone company permission to operate an exchange in this city does not confer upon that company the right to establish a system of pay stations with slot-telephones for its own profit. The terms of the agreement are very plain, and, it would seem, admit of no other interpretation. The corporation counsel says:

The company, by its contract with the city, is required "to permit the use to the gnral public and charge therefor 10 cents for a local connection and $25 increase upon the price" to be charged for a private telephone. The income from a public telephone under the schedule plainly belongs to the lessee of the telephone instrument where it is open to the use of the general public. It is plainly optional with such lessee whether he will make the charge or not, and the limit of the income to the company from the public use of that telephone is plainly $25 in addition to the price charged for the business use of the lessee and his employes alone. I am, therefore, of the opinion that the 'slot machine' cannot under the ordinance be used by the telephone company and that the same should be discontinued and the company required to adhere strictly to its contract with the city.

The company's franchise was granted January 4, 1889, and extends for a period of 20 years. The rates at that time were $100 for residences and $125 for business telephones. When used as public telephones the company charged an additional $25, and the subscriber was permitted to charge 10 cents for each message. The ordinance strictly prohibited any increase in these charges during the term of the franchise, and the company accepted this condition. The ordinance also provides that franchises may be granted competing companies and that the city shall have the right to regulate the charges of telephone service at all times.

The applications of the Röntgen rays, especially in the domain of medicine and surgery, are of constantly widening usefulness, although one hears less of them in the daily press, now that the keen edge of novelty has been blunted by a world's appreciation. Two fields of exploration made possible by the fluorescence of vacuum tubes, and recently entered, are of noteworthy promise. One is the examination of lung tissue in the case of consumption. The healthy lung gives comparatively little shadow in the sciagraph, while the diseased tissue has a much darker appearance in the picture. It is thus possible to ascertain exactly the portion affected and to attempt palliative or remedial treatment accordingly. The other recent use of the Röntgen ray of especial value is in observing the movements of the stomach and its contents in the preliminary digestive process. By mixing subnitrate of bismuth, which is said to be a harmless powder, with the food, the movements of the stomach may be seen by means of the fluoroscope, under suitable conditions. The knowledge thus gained is of great importance to the physiologist and the physician, as many facts hitherto unknown are revealed.

It is not strange that an English writer playfully remarked that the X-ray may yet be employed to read the riddle of the Sphinx. It is certain that Professor Röntgen gave to the world a discovery which is bringing to mortal gaze many of the deep-hidden mysteries of Nature.

The discussion which followed the reading of Mr. Holmes' paper before the Boston meeting of the American Street Railway association disclosed the fact that there was a wide diversity of opinion on the propriety of street-railway companies engaging in the amusement business. It was generally agreed that where municipalities furnished parks and pleasure resorts, the street-railway companies might stimulate travel on lines leading to these points by contributing toward the expense of furnishing music and other special attractions. It was not thought that the companies should be called upon to donate the park and run it, too, although this seems to have been done in a few instances. Some managers reported satisfactory results from the plan of furnishing an elaborate entertainment at resorts of this character, while others complained that the expense entailed more than counterbalanced the additional receipts of the lines leading to such resorts. It would seem that the question should be decided by local conditions. As one prominent street-railway man said, riding in street cars is greatly a matter of habit, and everything that tends to promote and confirm that habit is beneficial to street-railway companies. The force of this remark can readily be appreciated by reflecting upon the wonderful change that has been accomplished in this country during the last 10 years. Walking can no longer be considered an American custom. We ride everywhere, whether it be a few short blocks which we wish to get over in a hurry, or a trip through the suburbs for a breath of fresh air. The swift-running trolley car is a great temptation—too attractive to be resisted by the average American, who is always in a hurry.

Recent reports concerning the progress of the work of the Patent Office are gratifying to inventors and manufacturers who are interested in securing prompt attention for applications. It will be remembered that when the commissioner of patents appeared before the Congressional committee on appropriations during the early part of the present year and asked for an appropriation for an increased working force, he was met with the statement that it would not matter how much the examining force was augmented, as there would be no difference in the work accomplished. The commissioner promised satisfactory results if allowed an increased force, and an appropriation of $62,880 was finally allowed. Provision was made for the appointment of 18 additional examiners and assistant examiners and a number of clerks and copyists. As a result of this increase there has been great activity shown in the Patent Office, and a statement just issued by the commissioner announces that there are at this time exactly 2,896 less applications awaiting action than before the additional force was authorized by Congress. In speaking of the matter Commissioner Duell said that the work thus far accomplished demonstrated better than any argument what the increased force has done. The greatest harmony prevails in the office and the work is rapidly being brought up. Examiners who were months behind in their work are beginning to see the end, and the commissioner promises by the first of July to have the Patent Office in such shape that an inventor filing his application for patent will receive an action thereon within six weeks; and as time goes on that time limit will be reduced until the office is working on a prompt basis. This is what the augmented force has made possible, and inventors throughout the country will certainly rejoice at the new order of things.

Air-tight Arc Lamp for Submarine Work.

Two students of electrical engineering at the Sheffield Scientific School of Yale University—Irving E. Burdick and Francis G. Hall, Jr.—have devised an air-tight arc lamp which has been successfully used in submarine work at the Brooklyn navy yard. They were employed by the United States government early last spring to conduct the electrical part of the work of laying mines in certain harbors on the Maine coast. At that time the young men began to consider the feasibility of using the arc light under water. They conceived a scheme for carrying the idea into execution, and then communicated with the Navy Department in regard to it. Owing to the outbreak of the war nothing was done about the matter at first, but Messrs. Burdick and Hall were finally instructed to go ahead and to make experiments for the government. They did so, and the New York Tribune says that their efforts have been crowned with gratifying success.

Messrs. Burdick and Hall use an enclosed arc lamp and make the outer globe fit to the casing above it with an air and water-tight joint. Fig. 1 shows the lamp complete and Fig. 2 shows the component parts. The cylindrical casing, and indeed the whole lamp, is air and water-tight. Guard rods protect the outer globe, and the lamp is made strong and compact.

Most of the tests made at the Brooklyn yard were at a depth of 25 feet. But the lamp can be made to stand the pressures that would be encountered at any depth at which divers ever go. The greater part of the work done by men who examine and repair wrecks is done at depths not exceeding 25 or 30 feet. But it is said that the lamp can be made proof against the pressure of the water 200 feet below the surface.

The mechanism of the lamp is similar to that of any other 2,000 candle power lamp.

The powerful illumination of the arc light is a great aid to photography. Hitherto the only electric light used under water for photography has been of the incandescent kind. Light has also been obtained by exploding cartridges of sodium in a globe, but the duration of such a flash is brief. Much greater depths, especially in muddy water, can be penetrated with the arc than with the incandescent light, so that valuable results in submarine photography are anticipated.

Illumination for the Chicago Peace Jubilee.

A considerable force of wiremen is actively at work stringing the festoons of incandescent lamps over State street for the Peace Jubilee of next week. These overhead festoons will form the principal feature of the special electrical illumination in honor of the celebration. The design was illustrated in the Western Electrician of September 24th. The Union Loop structure will probably be illuminated, and a number of private firms will make electrical displays. In addition, the Chicago Edison, Western Electric and General Electric companies have offered to erect, without charge to the city, the municipal arch at La Salle and Washington streets. Mayor Harrison has accepted the offer, and the work is now under way. The arch will be about 40 feet high and will be ornamented by oil portraits of President McKinley and Mayor Harrison, with army and navy scenes and pictures of the heroes of the war. It will be studded with about 1,000 frosted incandescent lamps of 16 candle power each, and the keystone will bear the "I Will" motto in letters made of electric lights. The arch was designed by John E. Youngberg, an architect, and is being built in parts suitable for erection at the shops of the Chicago Edison company, under the direction of J. H. Goehst, the superintendent of construction for that company.

The special electrical illumination of the streets will be given on the evenings of October 18th, 19th, 20th and 21st, from 6:30 to 11:30 p. m. each day.

American Style of Electric Vehicles to Be Manufactured in France.

A company has been formed to manufacture in France electric carriages and chainless bicycles of the type exploited by the Pope companies of Hartford. The Iron Age is authority for the statement that the head of the company will be one of Europe's most influential financiers, Mr. Clement of France. The company is known as Les Usines Clement. A large plant, the main building of which is 800 feet long by 400 feet wide and of most modern construction, has just been completed at Levallois on the Seine, directly outside of the fortifications of Paris. In this building a fine equipment of American machine tools will be set up. The machinery will all be operated by electricity. Two 500 horse power engines have already been purchased in Europe. They will be directly connected to generators, which will drive motors operating lines of shafting. The electrical machinery and shafting have been purchased and are being set up in anticipation of the arrival of the machinery. The French company will pay a royalty on the Pope patents which are used. Mr. Clement is said to be the leading bicycle manufacturer of France. Gasoline as well as electric vehicles will be manufactured.

Car-axle Train Lighting.

All the passenger cars—day coaches, dining cars and sleepers—of the Atchison, Topeka and Santa Fe Railway company on limited trains are to be electrically lighted on the car-axle system. The company has been testing the system for nearly two years on cars running between Chicago and Denver, and is so satisfied with it that all the limited trains between Chicago and Denver and Chicago and Los Angeles are to be equipped. In this plan each car is an independent lighting unit, supplied with its own dynamo and storage battery. The dynamo is suspended on the car truck, and is driven by a camel-hair belt from a pulley on the car axle. The storage-battery cells are carried in a tray under the body of the car. The dynamo gets up to speed sufficient to generate current when the car has reached a speed of 10 miles an hour. The dynamo, storage battery and lighting circuits are designed and interconnected in such a way that the system is automatically self-regulating, maintaining even light whatever the speed of the train, the battery charging or discharging, as may be required. In addition, the battery, when fully charged, has sufficient capacity, it is claimed, to light its cars for 10 hours when standing still. Berth and aisle lights are provided, and it is also proposed to supply current for the locomotive headlight and the train tail-lights. Spare belts and some parts are carried on the trains, but the inspection for repairs and renewals is done at the terminals. No electrician or expert attendance is required on the train; the dynamo is oiled by the man who lubricates the car-wheel boxes. In case both dynamo and battery should become disabled at the same time, flexible connections with adjoining cars are the means of temporarily supplying current to the disabled car.

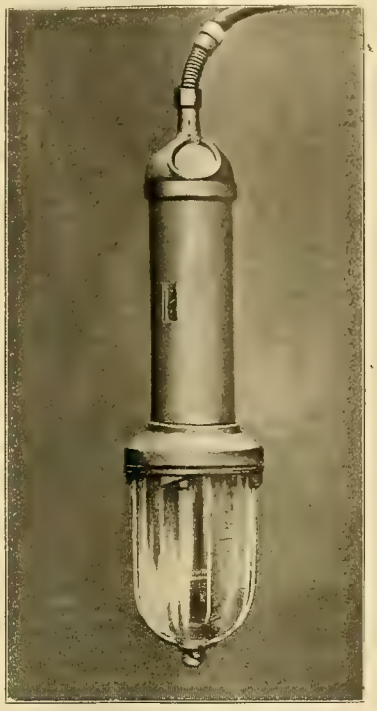


FIG. 1. AIR-TIGHT ARC LAMP FOR SUBMARINE WORK — APPEARANCE OF LAMP COMPLETE.

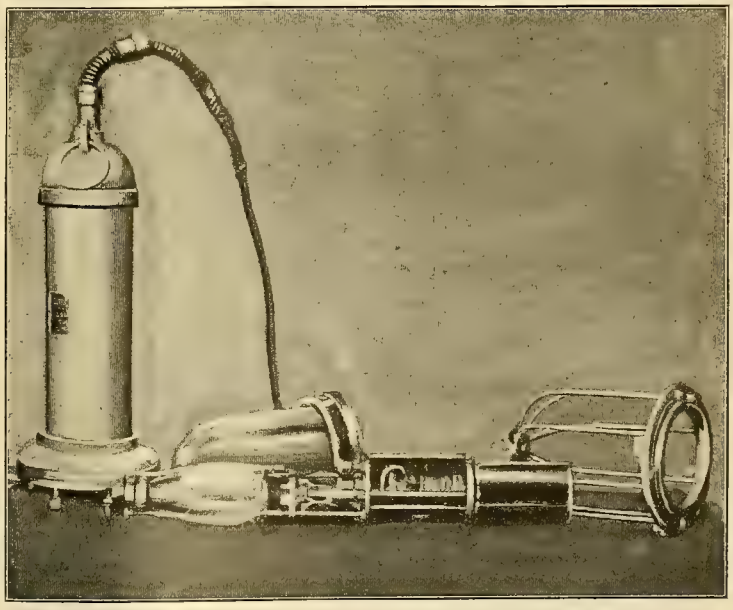


FIG. 2. AIR-TIGHT ARC LAMP FOR SUBMARINE WORK.—PARTS OF DISMANTLED LAMP.

Proposed Revision of the Patent Laws.

Judge P. S. Grosscup of Chicago, Mr. Francis Forbes of New York and Mr. A. P. Greeley, the assistant commissioner of patents at Washington, constituting the board of three commissioners appointed by the president to revise the patent and trade-mark laws, began their work by holding sessions in Chicago on October 6th, 7th and 8th. The next sitting of the commission will be in New York on November 19th and succeeding days. Afterward the commissioners will go to Washington.

The commission is in existence to "revise and amend the laws of the United States concerning patents, trade and other marks, and trade or commercial names, so far as the same relate to matters contained in or affected by the Convention for the Protection of Industrial Property, concluded at Paris, March 20, 1883, the agreements under said convention concluded at Madrid, April 14, 1891, and the protocols adopted by the conference held under such convention at Brussels, 1897, and the treaties of the United States and the laws of other nations relating to patents, trade and other marks and trade or commercial names."

The law creating the commission provided that a report of the work performed be submitted to Congress at the next session. The commissioners were directed to indicate such changes in existing laws as may be deemed necessary and to accompany these recommendations by notes.

Several attorneys and a few manufacturers appeared before the commission, and the discussion took a wider range than a strict construction of the instructions of the board might imply. Several patent lawyers advocated a repeal of the caveat law; others asked a legal definition of the term "trademark;" and varying opinions were expressed on the many perplexing features of the patent-law situation, in both its domestic and international aspects, which are, indeed, very closely related.

In answer to those who asked why, instead of revising our own patent laws to meet the ideas of others, we did not endeavor to induce foreign nations to come up to our patent-law standard, Mr. Forbes explained that foreign inventors were already treated so liberally by the United States statutes that there were no concessions left to offer other nations as an inducement to change their laws. It was thought that, with all its imperfections, the patent system of the United States was the best in the world, principally because it encouraged workmen and inventors to patent small improvements in apparatus. This caused the issue of a large number of patents, but made for general industrial advancement. In other countries, too, patents are taxed so much a year during the term of monopoly. Thus a patent is issued by the United States government for a fee of $35, and, aside from the attorneys' fees and the cost of the drawings, amounting to perhaps as much more, that covers the entire expense; in Germany a patent will cost its owner during its lifetime of 15 years about $1,000. Mr. Greeley pointed out the value of patents in promoting the export trade of the country.

Some of these observations were made at a dinner given in honor of the commissioners and others at the Union League Club by the Patent Bar association of Chicago. This dinner was a pleasant relief to the labors of the commission and was greatly enjoyed. The guests of the association were Judges Woods, Jenkins and Showalter, of the Circuit Court of Appeals; Judge Grosscup, Mr. Forbes and Mr. Greeley, of the commission, and Messrs. Arthur Steuart of Baltimore and A. J. Boult of London.

DEVELOPMENT OF THE TELEPHONE FIELD.

Slot-telephones in Chicago.

The agitation directed against the Chicago Telephone company by the Druggists' association, on account of the policy of the company in placing slot-telephones in drug stores throughout the city, has resulted in directing attention to the company's ordinance. More than a year ago the subject was considered in the City Council, and was finally referred to the judiciary committee, which in turn referred it to the corporation counsel. That official has carefully investigated the subject, and he has found that the action of the Chicago Telephone company is wholly unwarranted, and he advises the council to insist upon the corporation living up to the terms of its contract with the city. Following is the text of the opinion:

"There has been referred to me for an opinion, etc., a resolution with preambles in words and figures as follows:

Whereas, It is charged that the Chicago Telephone company has refused and is refusing in some instances to lease to parties desiring the same public telephones at and for the rentals fixed by and pursuant to an ordinance passed January 4, 1889 and published on page 742 of the Council Proceedings for the year 1888-89, and

Whereas, It is further charged that said Chicago Telephone company has resorted and is resorting to various expedients in order to compel lessees of such public telephones to allow the same to be removed, and in lieu thereof permit said Chicago Telephone company to install in the premises of such lessee what is commonly known as the "slot-machine" telephone; and

Whereas, The Chicago Telephone company is under legal obligations to furnish and lease public telephones to all responsible persons applying for the same, at the prices and for the rentals fixed by and pursuant to said ordinance passed January 4, 1889, and to render efficient and reasonable service to the lessees and others lawfully using said public telephones:

Now be it Resolved, by the City Council of the City of Chicago, That the corporation counsel be and he is hereby instructed to notify said company through its proper officers that upon a failure by said Chicago Telephone company to comply with said obligation of said company, under and pursuant to the terms of said ordinance, the city of Chicago will take due and proper steps to compel performance of said obligation by said company; and the city clerk also is hereby instructed to transmit a copy of this resolution to the president of said company.

"To fully understand the nature and scope of the proposed resolution it is necessary to consider the ordinance of January 4, 1889, which grants to said company its rights and privileges to operate telephones within the corporate limits of the city.

"By section 6 of that ordinance, with the acceptance of said company thereof, there was required to be filed by said company a schedule showing the rates charged by said company for telephone service at the time of the passage of this ordinance within the limits of the city of Chicago.

"That schedule is in words and figures as follows:

Schedule showing the rates charged by the Chicago Telephone company for telephone service on the 4th day of January, 1889, within the limits of the city of Chicago.

Within the blue lines on the map of Chicago attached hereto, and made a part hereof, we charge one hundred and twenty-five ($125) dollars per annum for telephone instruments connected by wire with our exchange, for the business use of the lessee and his employes alone. For the same connection to be used as a public telephone, with a right to permit the use to the general public, and charge therefor ten cents for a local connection, we charge twenty-five ($25) dollars increase on the above price. We charge one hundred ($100) dollars per annum for an instrument located in a residence and connected by wire with our exchange, the said instrument to be used only by the lessee and his family.

Outside of the territory bounded by the above-mentioned blue lines, we charge twenty-five ($25) dollars per mile or fraction thereof per annum extra: except where the location of the instrument is distant from our pole routes, in which case we make a proportionate increase.

THE CHICAGO TELEPHONE COMPANY,
By Geo. L. Phillips, President.

"Which, together with the ordinance and the acceptance thereof, constitutes the contract between the city of Chicago and the Chicago Telephone company, and is of binding force and must govern both parties thereto. The telephone company is required to rent telephone instruments connected by wire with its exchange upon terms prescribed in the said schedule. Public telephones must be furnished upon the terms therein prescribed, that is to say, the company, by its said contract with the city, is required 'to permit the use to the general public, and charge therefore 10 cents for a local connection and $25 increase upon the price' to be charged for a private telephone. There is no escape from this; the terms of the contract are plain and cannot be misunderstood. The introduction of the 'slot machine' is, in my opinion, a direct departure from the terms prescribed in and by the schedule. Instead of furnishing public telephones at such rental the company is refusing to do so, and insists in placing in their stead the so-called 'slot machine,' which enables the company to control both ends of the line for local connections. The income from a public telephone, under the schedule, plainly belongs to the lessee of the telephone instrument, where it is open to the use of the general public. It is plainly optional with such lessee whether he will make the charge or not, and the limit of the income to the company from the public use of that telephone is plainly $25, in addition to the price charged for the business use of the lessee and his employes alone.

"I am therefore of the opinion that the 'slot machine' cannot, under the ordinance, be used by the telephone company, and that the same should be discontinued and the company required to adhere strictly to its contract with the city and to the terms prescribed in and by section 6 of the ordinance, and the schedule above set forth.

"It will be observed that the departments of the city government are entitled to telephone instruments and their free use under the ordinance, but with this 'slot machine' it is not possible for the agents and employes of the city to communicate through outside telephones without paying to the telephone company a tariff of 10 cents for a local connection, which, I think, is contrary to the letter and spirit of the contract between the city and the telephone company."

The ordinance under which the Chicago Telephone company is operating, and to which reference is made in the opinion of the corporation counsel, expressly prohibits the company from increasing its rates of charges for service. According to the schedule filed at that time the company's highest rate was $125 for business and $25 additional where the instrument was used as a public telephone. Under the ordinance, according to Corporation Counsel Thornton, this is the legal limit the company is entitled to for service in this city.

Inspection Risks Taken by Telephone Linemen.

A lineman in the employment of a telephone company was injured by the fall from a pole caused by a shock received from the span wire of a street-railway company that used the pole in common with the telephone company. The trouble seems to have been that a porcelain insulator broke, by reason of which the guy wire came in contact with the charged wire of the railway company, and this guy wire, being attached to the pole which the lineman was climbing, was the wire with which he came in contact.

No case exactly in point could be found by the Supreme Court of Washington for its guidance in determining the case of Anderson against the Inland Telephone and Telegraph company, and it was forced to the conclusion that no absolute duty rested upon the master in this case to prevent the charging of a guy wire, or, in other words, to preserve inviolable the insulators, so far as the safety of the lineman was concerned.

The court recognizes that it is the duty of the master to furnish the employe with a safe place to work, and with safe and suitable machinery or appliances, and that this duty is a continuing one, which is imposed upon the master during employment. It also suggests that it may be stated as a corollary to this proposition that the law charges the master with knowledge which he ought to have had, and that it is settled law that he ought to know that which by the exercise of reasonable care he would have discovered; also, that it may be accepted as universally conceded law that the responsibility of the master cannot be transferred to another, and that when a duty is imposed upon him, and another is employed to perform that duty, the negligence of the agent will be imputed to the master.

But on the other hand, the court presents another universally accepted proposition, namely, that when a servant enters into an employment which is necessarily hazardous, he will be presumed to have assumed all the ordinary risks incident to such service; and the fact that the service is necessarily a dangerous one does not increase the master's liability if the injury resulted from the natural and ordinary incidents of the undertaking, presuming, of course, that the servant is a person of mature years and common understanding.

Under this rule, and the evidence showing conclusively that, while not nominally an inspector, the duties of the lineman embraced the duties of an inspector, the court holds that this lineman assumed the risk of the insulator breaking, and that he did not exercise the discretion which he ought to have exercised in testing this wire.

And while there is no gainsaying the rule that under ordinary circumstances the employe has the right to rely upon the fact that the master will furnish him a safe place to work and safe appliances, yet, the court says, the law does not intend that this shall be a blind and unreasonable reliance, but that reasonable men shall exercise in a reasonable manner the faculties of which they are possessed, and that it would seem to have been only such reasonable exercise of prudence on the part of this lineman to have tested this wire before he touched it.

Amenities of English Journalism.

A writer in an English electrical journal calls attention to the misrepresentation of a contemporary in the following manner: "I see that a fortnightly contemporary interested in telegraphic matters is about to publish a book on telephony, and recommends it to its readers, on the ground that it is 'the standard work on telephony,' and that 'there is not, and cannot be, any work to compare with it for fullness, lucidity and accuracy.' This, of course, is 'all very fine and large,' as the song says, but my contemporary has overlooked the existence of a work published by the proprietors of this journal, which has been recently adopted as one of the text-books for the City and Guilds of London Institute. Perhaps the authorities who made the selection did not know better, but their approval has hitherto been regarded as a guarantee of the value of a book, and will probably continue to be accepted as such, my worthy contemporary notwithstanding."

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

A peculiar instrument has been filed in St. Paul. It consists of a bill of sale of the franchises, plants and property generally of the Mississippi Valley Telephone company to the J. C. Hubinger company. It includes franchises in St. Paul and Minneapolis and Fort Madison, Burlington and Muscatine in Iowa. J. C. Hubinger owns the controlling interest in the Mississippi Valley Telephone company and did so at the time of the award of franchises. In St. Paul the franchise provides that it cannot be sold without the consent of the council. The recent deal between the Minnesota Central and the Bell interests may also have considerable effect on the Hubinger enterprise, for the latter was depending on the Minnesota Central for toll-line connection.

The Northwestern Telephone Exchange company has made a slight reduction in toll rates from Fargo, N. D., giving three minutes' talk for the price formerly asked for two.

A telephone line is being built from Rolfe, Ia., to Gilmore, via Bradgate.

A local telephone exchange will be installed at Alexandria, Minn., 87 subscribers being secured.

The Plattsmouth Telephone company of Plattsmouth, Neb., is installing an exchange there.

The Richland County Telephone company has taken possession of the Union Telephone company's system at Dodgeville, Wis., and is preparing to extend a line to Madison at once.

A local telephone company has been formed at Germania, Ia., to build a line to German Valley.

The Central Telephone company will establish a telephone exchange in Manson, Ia., at once.

The Kerlin & Moody telephone project to connect Park Rapids, Minn., with Menahga, is to be extended to take in Wadena.

Before November 1st telephone connection will be completed between Great Falls, Mont., and San Francisco, which, it is said, will be the longest telephone line in the world.

A New Telephone Manufacturer in Chicago.

The telephone buyers of the United States will be interested to know that a new telephone manufacturer has just started business in Chicago under the name of the Eureka Electric company. This institution was projected by I. J. Kusel, formerly president of the Missouri Telephone Manufacturing company of St. Louis. As is now pretty generally known, Mr. Kusel sold out his interest in that business and entered one of the largest telephone manufacturing establishments in the country. Since then he has been connected with another telephone factory. But being ambitious to control a business of his own, he has again entered the field as a manufacturer. Mr. Kusel is the president of the new company, and has associated with him H. J. Kusel as secretary and treasurer of the company. This latter gentleman was connected with the Stromberg-Carlson Telephone Manufacturing company, and without doubt his experience with the last-named institution will serve him in his new connection. In addition to the gentlemen already named, A. J. Kusel joins forces with the Eureka Electric company. He was until recently connected with the Chicago Telephone company and Central Union Telephone company. In the new institution he will have charge of the factory. The new company proposes to place on the market a most complete line of every variety of telephone specialties, switchboards, etc. The store of the company, in combination with the factory, is located in Chicago.

Telephone Repeater.

[From the London Electrician.]

From time to time experiments are made and results—all remarkably similar in character—are published on the problem of a telephonic repeater. The function of this instrument would be to occupy an intermediate position on long-distance telephone lines, and to receive the telephonic currents and repeat them in the form of current waves of greater intensity. The shape these inventions have hitherto taken has been that of a common diaphragm, faced by the magnets of an electromagnetic receiver on the one side and by a carbon microphone on the other, and the results have usually been that the transmission of speech is as good or better if the repeater is omitted. In the latest form of repeater, invented on the other side of the Atlantic, the same system is employed, but in this case the whole instrument is enclosed in a vacuum, the advantage of which is not apparent to us. The problem which such instruments attempt to solve is akin to that of the "bellowing telephone," and the latter was declared to be an impossibility at the recent British Association meeting. Those endeavoring to increase the distinctness of speech over long-distance lines, and to increase the possible distance over which telephony can be effected, should rather turn their attention to the line itself. A series of patient experiments, based on theoretical investigations that have already been made by an eminent mathematician, would probably lead to valuable results.

Telephony Abroad.

Many municipalities throughout Great Britain are preparing to renew their appeals for permission to establish local telephone systems in opposition to the National company's service. The policy of the government on the telephone question will not be decided till Parliament meets again, but, as remarked by an English contemporary, it is apparent that an early decision will then be required. P. G. Burrell, on behalf of the postmaster-general, has written to the town clerk of Glasgow the following letter: "With reference to the department's letter of the 16th inst., and to previous correspondence, I am directed by the postmaster-general to acquaint you, for the information of the corporation of Glasgow, that his grace will be prepared to give the corporation a license for a telephone exchange on their securing from Parliament the requisite powers for working an exchange system. I am to add that it will be a condition of the license that it will expire on December 31, 1911." The telephone committee of the Glasgow corporation will accordingly apply for the necessary powers, and after the select parliamentary committee's report it is believed that Parliament will either grant the request, or order the Postoffice to carry out the work of establishing a competitive exchange without delay.

In Manchester the organizers of the proposed competition with the National company have failed to secure the assistance of the Manchester Corporation which, however, passed a resolution affirming that it is not in the public interest that the telephone system of the city of Manchester should exist as a monopoly in the hands of a private company. Manchester is said to have been the only city of importance where competition with the National by the formation of other private companies was ever entertained. A Manchester newspaper says: "The sympathy of the general public sems to be veering to the idea that the telephone system, like that of the postal and telegraph service, is one which naturally lends itself to monopoly, and that such a monopoly is not socially injurious so long as it is controlled by the government and administered in the public interest. The opponents of compe ition dwell on the fact that it involves the laying down of two systems of wires in the streets, and that this necessitates a second disturbance of the footpaths and roadways. A dual system also carries with it a double charge upon almost every user of the telephones. Most business houses would find it imperatively necessary to be connected with both systems, in order to be in touch with all their customers, some of whom would perhaps be too poor to pay more than one premium. It is also urged that unless the dual systems were co-terminous, the one that covered a less area than its competitor would find itself considerably hampered whenever its subscribers desired to converse with their customers or friends in a district which it did not itself serve. Under such circumstances it would be only natural for the rival company to use its advantageous position to the injury of the weaker competitor. All these things, and more, have to be faced in the consideration of the question of setting up or supporting a telephone system which shall rival the one now in vogue." In this country where existing companies have so far forfeited the confidence and support of the public as to warrant the introduction of a competitive telephone system the independent company generally supplants the old company for local business.

The Chile Telephone company's annual return shows that 44,000 shares have been taken up out of a capital of £250,000 in £5 shares; and paid for in full.

At a recent meeting of the Court of Common Council the streets committee presented a report on the dispute between the corporation of London and the Postoffice authorities relative to the laying of telephone pipes without the permission of the former body. The committee submitted a letter from the secretary of the Postoffice intimating that the provision of wires between exchanges of the National Telephone company and the houses of subscribers was not contemplated. The letter further contained an assurance from the postmaster-general that if his present policy should be departed from, he would not construct any telegraphs under consent of the corporation within the city between the exchanges of the National Telephone company and the houses of subscribers without conveying to the corporation an intimation that the policy had been changed. The committee stated that, subject to that understanding and to the usual condition that the contractors to the corporation would be employed to make good the pavements disturbed, they had consented to the various applications of the Postoffice authorities for permission to open the public ways. The court agreed with the committee in the report.

An Apt Quotation.

[From the Yorkshire Post.]

Whatever may be the failings of the members of the Salvation Army, no one can accuse the headquarters staff of being deficient in humor. The penchant of the society for posting quotations from Scripture everywhere has shown itself in their telephone boxes, where, with great aptitude, the words quoted are, "Ye have need of patience" (Hebrews x., 3).

Extensions and Improvements.

The Morgantown, W. Va., and Dellslow Telephone company has been incorporated.

The Puget Sound Mill company has begun the construction of a telephone line between Port Gamble and Port Ludlow.

The Citizens' Telephone company, Magnolia, Miss., has been granted a franchise to build a local and long-distance telephone system.

The State Telephone company of Newark, N. J., has executed a mortgage for $1,000,000 to the Fidelity Trust company, covering all the lines of the company in the state.

Long-distance service has been established between several Iowa towns by the Overland Telephone company, an independent corporation recently formed at Hiteman.

At Athens, Tenn., the East Tennessee Telephone company is soliciting subscribers for a new telephone exchange, which will have regular connections with the East Tennessee company's line.

The Central Pennsylvania Telephone and Supply company is making preparations to furnish its patrons in Ridgway better service, and it will replace the present telephones with long-distance transmitters.

Residents of Washougal, Wash., are considering a proposition made by an agent of the Oregon Telephone company to establish and maintain a telephone connection with Portland, via La Grande and Vancouver.

The Atlantic County Telephone company has been formed to operate an exchange in Atlantic County, N. J. The capital stock is placed at $100,000, and the incorporators named are Frederick L. Benson and Alfred Dingler, Jersey City.

The telephone war which has been in progress in Atchison, Kan., between the new Atchison Telephone company and the Bell Telephone company has compelled the Bell company to make a reduction in its prices from $36 per year to $12 per year in business houses and from $24 to $9 in residences.

At the annual meeting of the Albemarle Telephone company of Charlottesville, Va., J. Edwin Wood was elected president and J. F. Harlan vice-president. The new board of directors includes John B. Moon, J. M. Robinson, P. Leterman, J. B. Andrews, M. Kaufman, W. J. Tyson, S. C. Chancellor, C. B. Stevens and C. H. Walker.

The city of Richmond is fighting the Southern Bell Telephone company, which is now doing business without a franchise. The Board of Aldermen recently suspended its rules and adopted unanimously a resolution providing for the employment of assistant counsel in the conduct of the case, which is now pending in the Supreme Court of the United States.

Kansas City, Mo., is paying the Missouri and Kansas Telephone company $4,000 per year rental for the police-signal system, besides $6,400 for having it put in operation. Alderman Otto will go before the Board of Public Works and suggest that the board confer with the telephone company with a view to ascertaining what it will cost the city to purchase the system outright.

Permission has been granted the New Long-distance Telephone company to construct its lines along the highways of Hancock County, Ind. There is a movement on foot now to organize a co-operative telephone company in Greenfield, Ind., with an invitation to the people in all parts of Hancock County to run their lines into its exchange and to connect with all subscribers in Greenfield without cost.

The main office of the People's Telephone and Telegraph company has been removed from Allentown to Columbia, Pa. At a stockholders' meeting the following-named officers were elected: President, H. C. Young, Columbia; secretary, A. W. Gieskie, Columbia; treasurer, M. R. Hoffman, Marietta. The company has a franchise for a line in Lebanon, and the contract for its erection has been awarded to the Eastern Electric Construction company of Philadelphia.

The following-named directors were elected at the recent meeting of the stockholders of the South Shore Telephone company, at Freeport, L. I.: George W. Bergen, John J. Randall, William G. Miller, William D. Carter, Charles D. Smith, George P. Bergen and Henry P. Libby. The company's service has been introduced into the villages of Freeport, Baldwins, Rockville Center, Lynbrook, Oceanside, East Rockaway, Hempstead, Garden City, Mineola, Merrick and Barnum Island.

One of the results of the military occupation of Cuba will be the extension of telephonic means of communication in the island. Orders have been given to Captain Brady, of the United States Signal Service, to begin the construction of an overland telegraph line from Guantanamo, via Santiago, to Manzanillo. The principal use of the line will be for the transmission of government dispatches, the present cost of message transmission by telegraph from Guantanamo to Santiago being 20 cents per word up to 30 words, and 12 cents for each additional word.

Michigan tax laws are confusing to those not familiar with the peculiar customs of Mr. Pingree's stamping ground. Telephone and telegraph companies pay taxes to the state on the basis of their valuation instead of in the form of specific taxes, as in the case of railroads, express companies, etc. The law provides that such companies shall pay taxes at the same rate that other property in the state is assessed. For this year the telephone companies paid $41,086.78 in taxes, the appraised valuation being $1,369,560. The Michigan Bell Telephone company paid $26,358.32, the Detroit company $6,460.02, the Citizens' company of Grand Rapids $2,586.83, and the American Telephone and Telegraph company $1,630.37. There are now 31 telephone companies in the state, where there was but one 10 years ago.

The Boston News Bureau gives the following "inspired" version of a recent transaction in the Northwest: "We understand that the purchase price of the 900 miles of independent telephone line in the Northwest, by the Erie Telephone company, was $50,000. Boston people do not realize the importance of the above purchase to the Erie Telephone company. The independent-telephone movement in the Northwest had assumed large proportions. There were five companies in the field with a capitalization of $360,000, all under the management of the Western Electric Telephone company. These companies owned 3,000 miles of toll line in the Northwest, practically embracing the entire toll-line opposition in the states of Minnesota, Iowa and the Dakotas, and reached 300 points not reached by the Erie company. The Erie company purchase was of the lines of the Union Electric Telephone company, which is the only independent company paralleling the Erie company lines, but as a result of this purchase the Erie company agrees to place Bell instruments on all the Western Electric company's lines at a small rental, which includes the cost of repairs, and both systems will be operated as one. This is declared to be the first instance where a Bell company has ever entered into an extensive arrangement with an independent company; the previous policy has been to ignore or fight the independents. In this case there is no transfer of stock, other than of the Union company, and the independent companies maintain their separate existence and build and maintain their own lines. This purchase is considered of great advantage to the Erie company, as it practically cuts off the new Minneapolis independent exchange from all toll connections, for undoubtedly in connection with the Western Electric company's lines the Minneapolis company would have been able to make inroads on the Erie company's business. This agreement likewise cuts off a number of other independent exchanges in various cities, as, under the agreement, only toll lines are embraced, and it prohibits any affiliation with lines other than those using Bell instruments.

Spaniard at the Telephone.

In the "War Sketches" of the Chicago Record, contributed by staff correspondents who accompanied the American army to Cuba and Porto Rico, Malcolm McDowell tells an interesting experience of a Spaniard attempting to use a telephone. The occasion was the visit of a party of American officers and correspondents to a garrison at Esteron, near Sagua, where they were expecting horses to carry them farther on their journey. They were disappointed, however, and one member of the party suggested that inquiry be made for the steeds. The story continues as follows:

"The lieutenant, at a word from Major Irlis, sprung from his chair, rushed to the wall, and instantly the whirr of the telephone bell reminded us we were not yet outside of civilization. We listened for the familiar 'Hello,' but, instead, a rattle of Spanish came from the lieutenant. He evidently was impatient, angry and embarrassed. He wanted us to know that he was doing all he could to bring those horses over the mountain trail with telephonic speed, and as he shouted into the telephone transmitter he became excited. He evidently waxed sarcastic, then he importuned, then the quick staccato of the imperative mood showed us he was not accepting apologies.

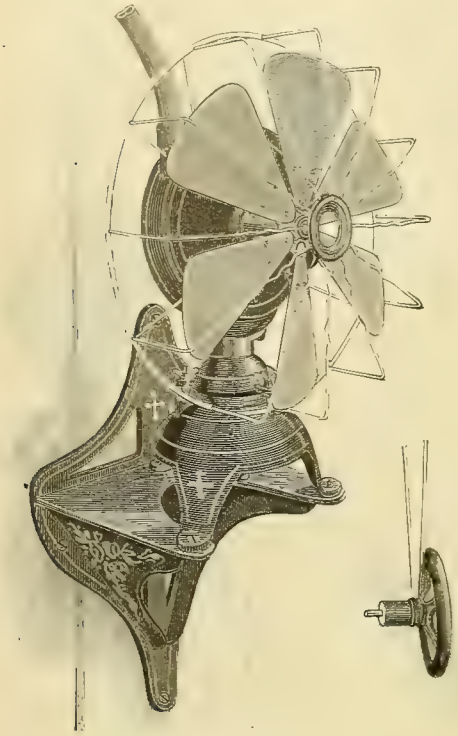
"As he became more earnest he shrugged his shoulders, and then we saw, for the first time, the cause of the partial failure of the telephone in Spanish countries. The Spaniard must gesticulate when he grows earnest. He must wave his hands, shrug his shoulders, shake his head and perform other pantomimic feats, and one cannot gesticulate with the hand which holds the telephone receiver and get much satisfaction from a long-distance conversation. This was the case with the lieutenant.

"His left hand waved in the air, described wide circles and shot out at queer angles with the telephone receiver tightly held in the fingers. A receiver held a foot from the ear is not the best way to carry on a telephonic talk, but the lieutenant gnashed his teeth, hissed out invectives, scowled into the unresponsive face of the weather-beaten instrument, stamped his feet and executed several full-arm motions of the most approved style of up-to-date calisthenics, while his little bride looked on approvingly and the Americans bit their lips to restrain their laughter."

America Water Motor.

The water motor made by the A. Rosenberg company of Baltimore, Md., and illustrated herewith, is claimed to be the best thing in the way of a water motor that has been made, being the only water motor that can be adjusted or tilted in any direction while running.

The motor body and stand being iron and finished black, while the ball and clamp ring of the ball and socket joint are polished brass, the motor has a



AMERICA WATER MOTOR.

very neat appearance. Leather packing rings are inserted in the socket and clamp ring, insuring a water-tight joint.

These motors can be set up anywhere, upon the special bracket shown in the cut or upon any rough shelf, and since the ball and socket joint admits of universal adjustment, the pulley can be lined up with a dynamo, sewing-machine, jeweler's lathe, fly fan or other light machinery, and the belt tightened while the motor is running. Hence it is never necessary to cut or shorten the belting to take up the slack; adjusting the motor body takes up the slack.

The motor is claimed to operate satisfactorily from the ordinary house supply, by attaching to any faucet where there is a pressure of 25 to 30 pounds or over. The seven-inch motor will, it is said, run over 2,000 revolutions a minute with 50 to 60 pounds pressure.

Water motors never get out of order, as is claimed, and will run for years without perceptible wear. They are noiseless in operation and require no attention whatever aside from oiling once a day.

The cut illustrates a motor seven inches in diameter attached to a 12-inch fan erected upon an iron wall bracket. The same style of motor is made nine inches in diameter also.

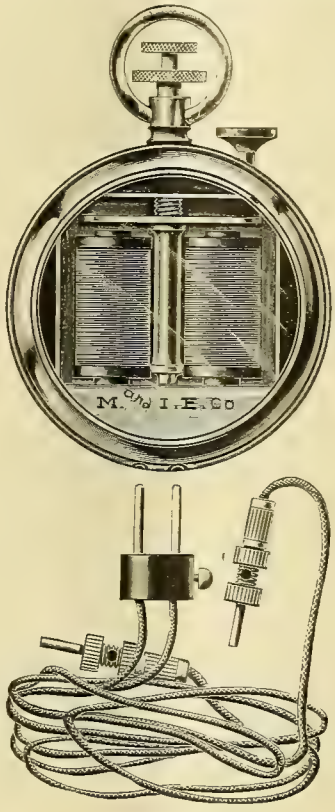
Illinois Electric Company.

In the Western Electrician of April 16th the announcement was made of the opening of a new

ILLINOIS ELECTRIC COMPANY.

electrical supply house in Chicago, the Illinois Electric company. Starting, as it did, during a period of depression, it was the opinion of a number of pessimistic friends of the projectors of the enterprise that success could not be expected. But others prophesied that the energy and training of the men in charge could not fail to bring its reward. And it now seems as though the latter opinion was borne out by most gratifying facts, for, from present appearances, the Illinois Electric company has made a creditable record. In fact, the company states most positively that its business has shown an increase every month and that the management has even been obliged to engage another floor. The company has three men on the road constantly, to say nothing of other representatives in the office, and it has been obliged to add another truck to its delivery department. This, to the observing business man, is an excellent indication of progress. It is the aim of this institution to carry a large stock, in order to make the quickest possible shipments, and in a recent circular issued by the Illinois Electric company, on its title page are presented several flattering testimonials relative to this important requirement in the management of any electrical supply house. "Prompt shipments" is the watchword of the Illinois Electric company, and from these testimonials it would seem that this effort to please is meeting its proper reward.

As is now pretty generally known, the personnel of the company consists of F. E. Healy, president, L. K. Cushing, secretary, and Carl Keith, treasurer. All have seen service in the business in one of the



THE MORSE WATCH.

largest supply houses in the West. Mr. Healy, the president of the company, has been "brought up" in the electrical-supply business. Mr. Cushing, the secretary, is no new comer, besides he is a member of an electrical family, and enjoys a tutelage from no less a personage than Professor Elisha Gray. The telautograph had no sooner acquired a practical standing than Mr. Cushing, who had assisted in the development, was deputized to exhibit the invention, and in this capacity traveled throughout the country. Of late he has been engaged in handling electrical supplies. Treasurer Keith started at the bottom of the ladder, and it is quite evident that his efforts to acquire knowledge of the business have been successful. He possesses a keen insight into financial matters, which, coupled with his experience in practical service, will prove valuable to the already popular combination.

The accompanying illustrations are views of the salesroom and stock rooms of the company.

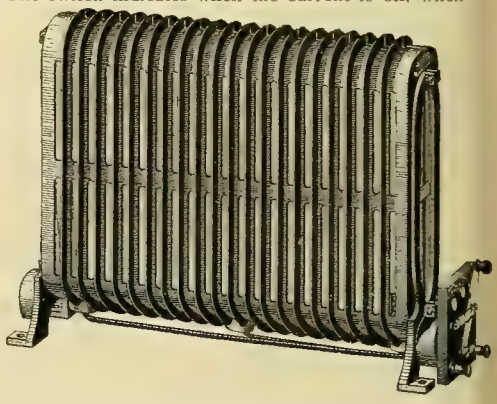
The electric-light plant at Tyndall, S. D., has been completed and put in operation.

Western Electric Heater.

The electric heater has a wide field of application in heating small offices, bathrooms, snuggeries, cold corners of rooms, street-railway waiting rooms, the summer villa on cool evenings, and the like. In mild climates it has a still wider range. It has the peculiar advantage of being instantly available, and the amount of heat is regulated at will. The heaters are perfectly clean, do not vitiate the atmosphere and are portable.

No definite rule can be given to determine the amount of electricity necessary for heating a given space, though approximate estimates can be made by allowing from one to two watts for each cubic foot of air space to be heated—the latter amount for well constructed buildings in cold weather or for quickly heating a bathroom. The electric heater is extremely valuable in the late spring when furnace fires are not in use, and, a sudden cold spell coming on, the electric current is immediately available and takes the chill from the room at a minimum expense and trouble.

The Western Electric company's heater, made in the shape of a small steam radiator, is 14½ inches long, 3⅜ inches thick, stands 12½ inches high, and is finished in black enamel or japan. It is made for two adjustments, half capacity and full capacity. The switch indicates when the current is off, when



WESTERN ELECTRIC HEATER.

half of the heater is used, and when it is all in use.

The heater is made for 52 and 104 volts; it is suitable for alternating currents and also for 110 and 220 volts, to be used on direct-current circuits.

The Morse Watch.

The "Morse watch," as shown by the cut, looks like an ordinary watch, but the case contains a telegraphic key and sounder. The sounder is both portable and secret. The instrument may be adjusted so that its click may be loud enough to be heard in any part of a comparatively large room, or the click made be made as low as the tick of a watch. The "Morse watch" is accompanied with a suitable flexible headband to fasten the instrument in place on the head, over the ear, leaving both hands free for transcribing messages or other work. It also has a neat silk conducting cord, with specially studied-out terminals, so that the instrument can be conveniently and quickly attached to or disconnected from the ordinary instrument of a telegraph line. It is designed for use in brokers' and newspaper offices, police stations, military telegraphs, etc. The contrivance is supplied by the Manufacturers and Inventors' Electric company of New York.

Chicago Time Recorder.

The cut shows the numerical time recorder of the Chicago Time Register company. The contrivance is a clock attachment which is useful in keeping a record of the arrival and departure of employes. It is intended for large manufacturing and mercantile establishments. Each employe has a numbered key. When registering he simply inserts the key in the clock and gives it a slight push, when a bell rings and his number and time are recorded in full view. Thus the illustration shows that employe No. 120 has recorded at seven o'clock. The employe sees that his name is recorded accurately, and thus all disputes are obviated. The key is not turned, thus avoiding any

delay or annoyance on that account. After having registered upon arrival, the employe hangs his key on the inboard, and when leaving hangs it on the outboard, so that it can be readily seen whether he is in or out. The clock is placed between the two boards.

Another style of recorder is called the autograph recorder and is adapted to keeping the time of employes in offices, banks, stores, etc., when it is desired to keep the time of employes or a record of the time consumed on different work. In this case the employe registers by signing his name on the record sheet, thereby lowering the wrist support upon which he rests his hand while writing, which causes the machine to automatically print the time opposite his name, and in his full view. The autograph signature prevents the recorder from being tampered with.

These machines are stated to be most carefully constructed, the recording mechanism being simple and durable, while the clock movement is of the Seth Thomas manufacture.

Improved Brush Arc Lamps.

In re-designing the well-known single and double-carbon Brush arc lamp, the necessity of producing durable lamps with easily renewable parts has been the object of special consideration. In the latest type, now put out by the General Electric company, every improvement has been incorporated which long experience has shown to be advisable.

The differential Brush arc lamp is especially valuable where a large number of lamps are run from one generator. The differential winding consists of a coil of coarse wire in series with the arc and a

CHICAGO TIME RECORDER.

fine-wire coil connected around the arc. Current in the coarse wire tends to separate the carbons, while in the fine wires it operates to bring them together, and, the opposite forces exerted by the shunt and series windings being automatically balanced when the carbons are burning normally, if the series current is reduced the voltage at the lamp correspondingly diminishes. With differential lamps, generators can, therefore, be heavily overloaded. The improved Brush lamp is adjusted at the factory, and, as the mechanism is not dependent upon springs for any of its movements, this adjustment cannot change. Hence the lamp runs as economically after several years of service as when first installed. It regulates so closely that the voltmeter on a circuit of lamps shows no appreciable variation.

These lamps do not require hoods when hung outside, as all parts are thoroughly protected from the weather. The chimney and its base are cast in one piece, and wherever a screw enters the lamp from above, its head rests on a boss which prevents the entrance of rain or melted snow. The outside terminals of the lamp are made with petticoats as a further protection against the entrance of water.

All parts are made by special machinery and are interchangeable. There are no springs to adjust or replace. The various contact surfaces are ample and the insulation is so distributed that the danger of short circuit is eliminated. The use of one large insulating strip diminishes the number of insulation pieces required to secure the lower frame in position. All brass parts, except the carbon rods, are finished in nickel-plate, adding to their durability as well as to the appearance of the lamp.

The mechanism frame has been so modified that the armature lever is now supported by a base separate from the frame and mounted on a plate which insulates it entirely from the frame and zinc bottom of the lamp box. The armature lever has been slightly changed on account of changes in other parts and also to so support the balance wire in the double lamps that the second carbon feeds at practically the same voltage as the first carbon. This improvement makes a marked saving during the entire second half of the night's run, often amounting to from 30 to 50 watts.

Realizing the advantage of using a lamp on circuits of either 6.6 or 9.6 amperes, the magnets of this new lamp have been so designed that when changing from one circuit to the other it is only necessary to exchange the adjusting coil for one suited to the new rating. The adjuster formerly sent out may be used for 1,200 candle power (6.6 amperes), but should be changed to one of coarser wire when used for 2,000 candle power (9.6 amperes). The new magnets are interchangeable in pairs with those of the old-style lamp, but new magnets for old 2,000 candle power lamps must be always used with the new adjuster for 2,000 candle power.

The new adjusting coil is furnished with a screw clip which compensates for about one ampere more or less. When changing or renewing this coil it is only necessary to loosen two screws. The magnets may be removed by simply taking out four screws and unhooking the small brass connecting springs. The connection springs furnish a most convenient method of connecting the magnets into circuit, and are of such size that the current they carry cannot heat them enough to change their tension.

Successful operation requires at all times a perfect contact between the rod and the inside terminal. In this lamp it is necessarily a sliding contact, and the brush used keeps the surface bright and clean. The new brush is one inch wide, punched out of phosphor bronze, and so slotted as to present five narrow fingers crosswise to the rod. The same punching is used on both single and double lamps, the double lamp requiring two strips and the single lamp one strip, bent double. When worn out the contact brush may be quickly replaced without disturbing any other parts of the lamp. The improved contact is interchangeable with the old if the new contact-support bracket is also used.

No part of an arc lamp is more affected by wear than the carbon rod. Each day the exposed portion of the rod is rubbed, and in time its diameter is so reduced that the clutch opens more quickly than when the rod is full size. The new form of clutch makes the feeding of the lamp independent of changes in the diameter of the rod. The wear caused by scouring is on the lower half, the part that rests in the bushings when new carbons are in the holders, and the best alignment is necessary. To overcome the trouble due to excessive wear a reversible rod is introduced, which may be quickly removed, turned end for end, and put back into the lamp while the lamp is hanging in position. The reversible rod lasts twice as long as the old rod. It also prolongs the life of the contact brushes, the guide bushings and the clutches, a rough or pitted arc causing arcing and increased friction.

The rod caps are held in place while the rod is unscrewed, and are long enough to remain in position on the upper bushing when the rod has been removed.

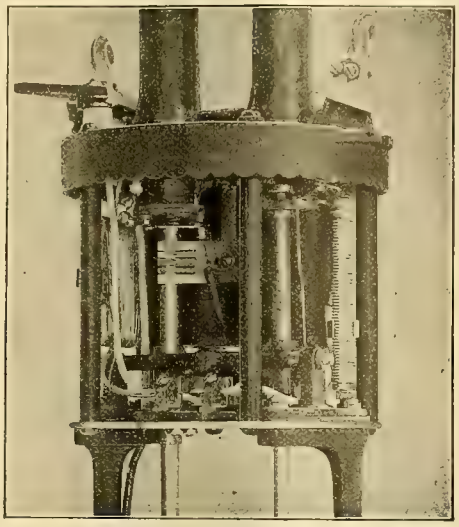
The two things necessary in a satisfactory carbon-rod clutch—absolute uniformity of grip irrespective of the condition of the rod and a means of accurate adjustment for wear of the rod or clutch—are found in the improved clutch. The surfaces bearing on the rod are so long (1¼ inches) that the grip is not affected by roughness, dirt or even dents in the rod. To adjust the clutch the position of the trip is changed by loosening one screw only.

The shoe is of peculiar construction, being pivoted above its center to a lever which, itself, is so pivoted to the clutch body as to give a motion to the shoe perpendicular to the rod when the lever moves vertically. In action this clutch is positive, releasing the rod at a given point and instantly gripping it again when the lever is raised. The rod is always either firmly clutched or entirely free to fall. The clutch comprises but four parts beside the screw and rivets, and the same clutch is used on both single and double lamps. The bushings for guiding the carbon rods must be replaced occasionally, a worn-out bushing being often a source of trouble. The main inside terminals of the lamps have been so modified that but a few minutes' work is required to replace a worn bushing. The carbon rod is removed from its cap, the worn bushing unscrewed, the new one inserted and the rod replaced. The new bushings cannot be used in the old lamps without a new inside terminal, which may be substituted for the old terminal and admits the use of the new upper bushings also.

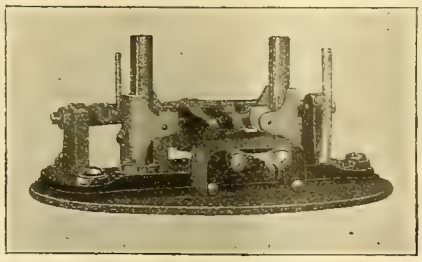
The carbon holders have a "V" grip on the carbon. The upper holder is made in two sizes, taking seven-sixteenths or one-half inch carbons and nine-sixteenths or five-eighths inch carbons respectively. It may be supplied with a flange to prevent injury to the rod, in case of a flaming carbon. The lower carbon holder takes any size of carbon from seven-sixteenths inch to five-eighths inch inclusive. Its position is adjustable. To enable them to resist corrosion the holders are nickel-plated.

The starting resistance is wound on a separate frame, which may be quickly removed, as only one screw with a metal clamp secures it to the side frame of the lamp mechanism. The cut-out is operated by the mechanical movement of the armature. When the current is too weak to energize the magnets, the armature falls by force of gravity, throwing the cut-out into circuit. Its contact surfaces are broad, and, as they are vertical, dust cannot collect on them to prevent good connection.

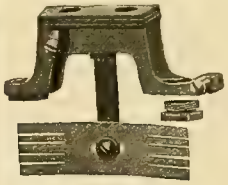
In cases of accident to the main circuit of the lamp, such as breaking the carbons, the whole current of the lamp would tend to flow through the fine wire of the magnets before the armature would have time to drop and throw in the cut-out. To prevent any possible damage during this brief interval, an auxiliary cut-out is inserted, which at such a time opens a path for the total current around the magnets until the main cut-out can operate, when the auxiliary cut-out is itself thrown out of the circuit. On the double lamp the globe-holder is secured by a thumb-screw, the loosening of which permits the globe to be lowered until stopped by the nut on



Mechanism with Casing Removed.



Support for Armature Lever.



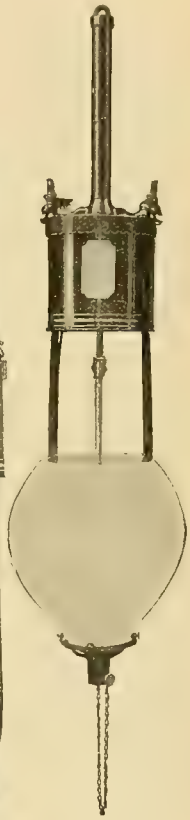
Double Carbon Brush and Inside Terminal.

Clutch with Rod Released

Clutch Shoe, Showing Location of Pivot.

Cut-out.

Double Carbon Lamp.



Single Carbon Lamp.

IMPROVED BRUSH ARC LAMPS.

the center support rod. The globe holder on the single lamp is also secured by a thumb-screw, and when lowered is supported by a chain attached to the lower frame of the lamp. If desired, the double lamp is supplied with drop tubes for the lower carbons. The globe-holder of the single lamp for indoor use is fitted with a dust-pan to prevent sparks and dust dropping through the globe-holder.

When lamps are to be used indoors or in protected positions, sheet-iron casings are furnished, but if they are to be exposed to the weather, especially near salt-water, or in a location where corrosion of the iron is likely to take place, the use of a copper casing is recommended. By simply pressing a spring clip on the upper side with one hand, the casing may be removed. All casings are finished in black enamel.

No solder is used in assembling the lamp and no tool but a screwdriver is required to take it apart.

To What Extent Should Street Railways Engage in the Amusement Business?

[*Continued from page 214.*]

Speaking for Kansas City, I am convinced that we ought to let the city furnish the parks while we contribute towards the music and attractions in the park. The difficulty in establishing public parks in Kansas City was due to the fact that the street-railroad companies had been quite liberal in providing parks. The people expected the companies to do it, and it is hard to overcome that feeling.

Mr. Beggs, Milwaukee: For some years we gave in the public parks of the city band concerts, of which the street-railroad company paid the entire expense. I thoroughly believe that that form of entertainment should be encouraged, and our company has a standing offer to duplicate any amount of money expended by the city or raised by public-spirited citizens for the purpose of giving music in the parks. Our experience, however, for two years was that where we paid the entire expense, we never got back more than 75 cents for each dollar spent. While we seem to have an increase of gross receipts, which increased our gross-receipts tax likewise, and made us seem to be doing an abnormal business, we were actual losers on the scheme. I do not believe that it pays a street-railway company to go into the amusement business. I believe in promoting the public parks of a city, maintained either by the municipality or by public-spirited citizens, but I seriously doubt whether any of these expensively maintained entertainment resorts pay the companies that promote them. If the same enterprise and money had been expended in improving the facilities for travel, in making the cars more cheerful and comfortable and improving the roadbed, it would bring much larger returns than in spending it for a couple hours' diversion in the afternoon or evening.

Mr. Harrington, Camden: We have a park and we have had considerable trouble, due to the fact that people would come to the park and take the best seats and would not ride on our cars. The park is very near the city, and in order to guard against that we furnish the ticket on the car to each passenger desiring to go to the park, and charge the 10 cents entrance fee to others. This method effectually shut out the objectionable element, and by the use of the ticket we determined the number of people going to the park. We find that while our travel is increased, owing to the expenses of operating the park, we received only about 70 per cent. income from the park of what the park cost to operate. The travel on the road, of course, is increased, and we can tell from the tickets just the amount. We think we are making some money, but whether we would make the installation and furnish the park if we had to do it over again is a question.

Mr. Farson, Chicago: The coming railroad manager who will be highly esteemed will be the man who not only gives his attention to reduced cost of operation, to the question of the very best electrical equipment, to the very best manner of handling his cars and to seeing that his track is kept in the very best condition, but also to the question of stimulation of travel. As has been well stated, the matter of riding on the cars is a question of habit largely, and in many cases today where roads are operated at a loss, or just about even, or at a small profit, a little attention to this matter would mean dividends to the stockholders. From the standpoint of a stockholder I am very much interested in this question. It seems to me that the practical operators of roads could take this question up and study it, with great interest to people who own the stock. Conditions, of course, vary. In many small towns of 10,000 to 30,000 people, a little attention paid to the operation of a park, either directly by the company or by inducing someone to operate it for you, would mean to-day a dividend to the stockholders. Street railways, like other institutions, need leaders and not followers. At the heads of these institutions should be broad-minded, wide-awake, up-to-date men who will study carefully the conditions in which they are situated and use their effort and their energy for the purpose of bringing money into the treasury of the company.

Mr. Claflin, Boston: We of the Norembega Park, to which you are invited, have had a very different experience from some of the gentlemen who have spoken. We have adopted a different system from most of the street-railway parks in Massachusetts, and it has certainly been a great success for the park and the railway. We have adopted the practice of charging an admission fee for the park and discriminate in favor of our railway patrons. Our railway carries its patrons a distance of 5½ miles for five cents. We sell on our cars for 15 cents a round-trip ticket which includes admission to the park. We charge people going on foot or bicycles 10 cents admission. The result is that the railway patrons get admission for five cents and the other people pay 10 cents. That has a tendency to bring passengers to the railway company, and it has been a great success with us. The result has been that the park has maintained itself. Our line is a small one, but the patronage has been worth nearly 600,000 fares to us, at five cents each, as the result of the park entertainments. The admission to the park is through a registering turnstile, and we know where the patrons come from. The statement may be of interest as showing circumstances where a park can be made to maintain itself as an enterprise, and the railroad not be put to any expense. The admission fee is small. We furnish theatrical entertainments, have a zoological garden, band concerts and other things, and manage to make the admission fee pay the entire expenses, and also the interest on the money invested in the park, and the railway company gets its revenue net.

CORRESPONDENCE.

New York Notes.

New York, October 10.—The incorporation of a company with $25,000,000 capital, known as the New York Gas and Electric Light, Heat and Power company, has naturally excited a great deal of speculation. The company is authorized to do business in this city, and its wide scope is indicated by its title. The names of R. P. Flower and Anthony N. Brady are connected with the venture by some of the guessers; others profess to believe that the new company has been incorporated by the moving spirits of the Metropolitan Street Railway company to do the lighting and power business which that company is alleged to have in contemplation. I have before alluded to the persistent rumor that the Metropolitan people were going into the lighting business; it seems to be widespread, but President Vreeland is reported to have said that his company has all it can well attend to in its railway business, and that seems to be a reasonable conclusion. But consolidations and big deals are the order of the day, as is shown by the experience of the Brooklyn surface-railway and electric-lighting companies. The outcome of the $25,000,000 incorporation is awaited with much interest. In the meantime the reduction of rates by the Edison Electric Illuminating company of New York may be significant. The established company appears to be making a determined effort to get new business. As an inducement for the use of electric light in place of gas, rates have been reduced for the months of October, November and December, 1898. If satisfactory results are obtained the company will not only make the rate permanent, but will also make a still further reduction, thus meeting the gas companies on equal terms. The new rates are so arranged that the longer an electric light is burned, measuring by the hour, the cheaper proportionately will be the light. Under the old electric-light schedule 10 lamps, which are the required number estimated for the ordinary small retail store, would cost $11.25 a month for a daily consumption of five hours. Under the new schedule this is reduced to $9. One of the officials of the company said that the company proposed to make electricity not only the best light, but the cheapest that could be obtained for the purposes of ordinary consumption. He remarked that heretofore it had been used largely for advertising effects and other special purposes. From now on it was proposed to educate the people to its advantages and economy.

The Third Avenue Railroad company has given notice to its stockholders of the issue of $2,000,000 additional stock, making the total amount $12,000,000. It is understood that this notice is preliminary to a comprehensive scheme for raising money with which to equip the road with electric power. According to reports current in Wall street, the directors of the Drydock, East Broadway and Battery line, the Union railway ("Huckleberry road") and the Forty-second Street, Manhattanville and St. Nicholas Avenue railway have adopted resolutions to consolidate with the Third Avenue road. The stocks in these companies are largely controlled by holders of Third Avenue stock, it is said. The reports say that the capital of the consolidated companies will be fixed at $53,000,000, of which $35,000,000 will be new issue. The Third Avenue road has a number of valuable franchises which it will develop, it is said.

Colonel Eugene Griffin did not recover from his illness contracted in Porto Rico as quickly as had been anticipated, but he is mending slowly at his home in Ardsley. The Tribune understands that when Colonel Griffin has fully recovered his health he will sail for Porto Rico, to resume command of his regiment of volunteer engineers, which is now occupied in military engineering and construction work in that island. M. S.

PERSONAL.

Mr. R. E. Gallaher, the secretary of the New York Insulated Wire company, is in Chicago.

F. C. Finkle has accepted the position of chief engineer of the Redlands (Cal.) Electric Light and Power company. This company will develop water and erect a power house for the generation of 1,500 horse power.

The marriage of William D. Kurz and Miss Mary McKenzie at the bride's home in La Crosse, Wis., is announced. Mr. Kurz is a member of the firm of Kurz & Root, consulting electrical engineers at Appleton, Wis. He was in charge of the Edison plant at La Crosse for several years prior to 1893, when he went to Appleton to establish his present business.

Two well-known out-of-town street-railway men—C. F. Holmes of the Metropolitan Street Railway company of Kansas City and C. G. Goodrich of the Twin City Rapid Transit company of Minneapolis—were in Chicago last week. They left together for an eastern inspection trip of two or three weeks' duration, intending to visit plants in New York, Boston, Washington and other cities.

Ottawa boasts of several old-time telegraphers whose work has done as much in developing the Dominion as their friends have contributed in this country. The Ottawa Evening Journal contains biographical sketches of several of the more prominent, including N. W. Bethune, Thomas Ahearn, W. Y. Soper, H. B. Spencer, C. W. Spencer, now of Montreal; D. C. Dewar of Montreal, George F. Macdonald and O. Higman.

ELECTRIC LIGHTING.

Silas F. King and J. A. Elliott have applied to the council of Butte, Mont., for permission to erect and maintain poles and wires along the streets of the city, for the purpose of furnishing light, heat and power.

On October 20th a special election will be held, in accordance with the franchise law of the state of Iowa, to allow the citizens of Emmetsburg the opportunity of balloting on a 20-year electric franchise, which is asked by John McNamara of Fulton, Ill.

The committee on judiciary of Provo City, Utah, has recommended that the city erect its own electric-light plant. It is suggested that the site on the Timpanogas Canal, near where it leads out on Pole Canyon Bench, be selected for a water power, and it is also recommended that preliminary action be taken at once toward the construction of the plant.

Concessions for electric lighting and traction in Smyrna and Salonica have been granted by the Porte to Sir Ellis Ashmead Bartlett, M. P., who stood out for Turkey in England at the time of the Armenian massacres. Priority of right is promised him also in Constantinople whenever the sultan makes up his mind to allow electricity in his capital.

ELECTRIC RAILWAYS.

It is said that the Southern Pacific Railway company is contemplating the introduction of electric power for the trains used in its suburban service at Los Angeles, Cal.

The Sunset Power, Mining and Milling company has been incorporated, with a capital stock of $1,000,000. One of its objects is to build an electric railroad from Index, Wash., to the mines at Calina, about seven or eight miles long.

In accordance with the recommendation of the collector of customs at Philadelphia, the Treasury Department has authorized that official to allow on the exportation of electric-motor trucks, manufactured by the J. G. Brill company of Philadelphia, a drawback equal in amount to the duty paid on certain imported roller or ball bearings and journals used in the manufacture, less the legal deduction of one per cent. The imported bearings and boxes used in the construction of the trucks to be exported must be duly identified by the proper officer of the customs.

ELECTRICAL SECURITIES.

The New Orleans Traction company reports gross earnings for August of $107,380, an increase of $322 as compared with the same month of last year, and net $31,266, an increase of $4,863.

The North Shore Traction company reports gross earnings for August of $180,741, an increase of $3,347 as compared with the same month of last year, and net $101,518, an increase of $718.

Stockholders of the Columbia Construction company of Chicago have been formally notified by D. H. Louderback to call for their 40 per cent. of Union Loop stock bonus to which they are entitled under the terms of the second subscription call. A sale of Columbia Construction stock was made recently at 65. This price was made on 100 shares, which carried with it the 40 shares of Loop stock bonus. Figuring the Loop stock at 68, the price at which sales have been recently made, this would establish a quotation of about 37 on the Columbia Construction stock.

The financial writer of the New York Sun devotes considerable attention to the recent fluctuations of stock, and explains that much of this varia-

tion is due to manipulation and not to change in actual values. He cites some electrical securities as examples and refers to the opinions generally expressed to explain these changes: "Certainly, nothing in the work which the Metropolitan Street Railroad company has done or is now doing indicates a purpose on its part to go into the electric-lighting business. All the conduits it has laid and is now laying, are, as its president has satisfactorily explained, needed for the propulsion of its cars, and an entirely new system of subways would be required for the furnishing of electric light. Five years ago Manhattan Elevated stock was selling at 175 and is now below par. Recently the Stock Exchange has been treated to a variety of rumors concerning this stock, one of which has been already mentioned, namely, that Mr. J. Pierpont Morgan was buying it, with a view of assuming the management of the company. Another rumor relates to the adoption by the company of electric motors for its trains and another to its consolidation with the Metropolitan Street Railway company. The only fact of which the public is at all assured is that the earnings of the company, owing to the competition of the trolley cars of the street-surface roads which parallel its lines, are much reduced below what they once were."

MISCELLANEOUS.

It is said that David McCullum is organizing a company in New Brunswick, N. J., for the purpose of manufacturing a rubber substitute asserted to be superior to any heretofore made. It costs nine cents a pound, while rubber costs $1.09.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until October 18th for furnishing the navy yard at Norfolk, Va., with one electric traveling crane. Intending bidders desiring specifications and blank forms of proposals can obtain them upon application to the Navy Pay Office at Norfolk or to the Bureau of Supplies and Accounts, Washington, D. C.

A recent dispatch to the St. Louis Globe-Democrat from Joplin, Mo., says that zinc ore has taken another jump, advancing from $30 to $33 a ton. Never before since the discovery of zinc in Southwest Missouri have the prices of this ore continued at such figures as for the last month, ranging from $30 to $34 a ton for ore in the bin. The present advance is attributed to the increasing demands for zinc ore. New mines are being opened all over the district, and many abandoned mines are again being worked.

The review of the River Plate of Buenos Ayres says: "The tricks of the electric-light wiremen (as they are pleased to call themselves) in this city are numerous. We have heard of one who did not believe in prepared tape for covering the joints, but made his own by dipping bits of old rags in paraffin. Another excused himself, when it was discovered that half the joints were not soldered, on the plea that he had not had time, but he had found enough time to cover over all the joints with tape, and he waxed wroth when an engineer told him what he thought of him and his work. The excuses made for low insulation are numerous and varied, but no wireman has ever yet acknowledged that this is due to scamped work. There is such a boom in electric-light work now, that everybody is going into the business, but many will retire with burned fingers and dearly bought experience."

The Supreme Court of Georgia has made an important decision in the case of the Brush Electric Light and Power company against Wells, a suit against an electric-light and power company brought by a widow for the homicide of her husband, alleged to have been killed while in the employment of the company through the negligence of the defendant. The burden was on the plaintiff of establishing such negligence on the part of the company, according to the ruling of the court, and this could not be done simply by showing due care on his part. For this reason, the court holds that it was error for the trial judge to charge, in effect, in this case, that the plaintiff would be entitled to recover damages if the husband's life was lost through the negligence of the defendant, or if it was not through the fault of the husband, and to charge further, that "the servant must show that the master was at fault or show that he was not at fault." It was not admissible for a witness, who was not shown to be an expert, the Supreme Court further insists, to testify, over the objection of counsel, that the deceased was doing the work he was required to do at the time of his death in a proper or an improper manner, such testimony being an expression o. opinion and not a statement of a fact.

A correspondent at Los Angeles, Cal., says that Shasta County is having an important revival of mining business. Old properties that were abandoned years ago, either because their ores were not free milling or because their treatment was not understood, are being worked again, and prospecting is going on more extensively than for many years. Old dumps have been found valuable by the new methods and are being worked, while mines that have hitherto been worked only to one or two hundred feet are being put down to greater depth, with the result that many have found either a lost ore body or an improvement of the existing ledge. Much of this revival is due to the Mountain Copper company, which has made a market for smelting ores and has done custom work. This company has bought a large group of claims near the Iron Mountain mine, on which they have put a large plant and done considerable development work. The ledge is 60 feet wide, of low-grade ore. The great copper belt of Shasta County begins at Iron Mountain and follows a northeast course in a semi-circle for 25 miles. At various points on this belt exploiting is going on by large companies, the principal ones being the Lewishon Bros. of New York, Salee & McDonnell, and a company of Berlin and Dusseldorf capitalists. The Mount Shasta mine, near Shasta, is down 140 feet on a three-foot ledge containing a streak of high-grade ore. The Bullychoop mines are about to be reopened by an English corporation.

TRADE NEWS.

The Fire Department of Milwaukee indorses and authorizes the use of the Montauk cable in connection with the auxiliary fire-alarm system in that city.

The Becker Name Plate company of Boston is sending to all applicants a neat paper cutter, with the name plate of the company stamped on it in a manner that makes it quite attractive.

J. C. Welles of Butte, Neb., will be in the market next month for dynamos, wire, water wheels, three miles of water mains, two 1,500,000-gallon pumps, etc., for the new town of Perry, at the terminus of the new railroad now building on the Atkinson and Northern.

The Orne Electrical Construction company of Chicago assigned on October 8th to E. Wallace Pease. The assets of the company, at 111 West Harrison street, are estimated at $5,000. It is thought that the liabilities will not exceed the assets. W. N. Wegg is president of the corporation.

A fine catalogue of recent issue is that of the Link-belt Machinery company of Chicago. It treats of "Modern Methods" of handling raw and manufactured products and of the transmission of power. Its 300 pages are excellently printed and profusely illustrated, and the book as a whole will be a welcome addition to the mechanical engineer's library.

Two interesting circulars have been issued recently by the Westinghouse Electric and Manufacturing company of Pittsburg. One relates to generators and rotary transformers for electrolytic work —copper refining and the like—while the other describes the new polyphase inductor generators, in which both armature and field windings are stationary. The rotating part carries iron pole-pieces and is known as the inductor.

That enterprising supply dealer, the Electric Appliance company of Chicago, has issued a 100-page catalogue devoted solely to telephones and telephone supplies. The publisher has essayed to produce the most complete telephone catalogue ever issued, and it appears to have succeeded. Not only instruments, switchboards and batteries are listed, but all sorts of supplies, tools and instruments necessary or useful for the telephone lineman are also described. The pamphlet contains some wiring diagrams and not a little useful information. Every tool or piece of apparatus is illustrated, and the price, code word and trade number are given. The catalogue should prove of value to all telephone users.

The extent of the independent telephone industry is well illustrated by the very respectable proportions of the well-filled catalogue of the Western Telephone Construction company of Chicago. The book is attractively printed, with red edges, and bound in gilt-stamped flexible covers. It has many good illustrations and shows the apparatus of the company in detail, giving portraits and views of the factory as well. Much attention is devoted to switchboards, and the new Keelyn telephone receiver is described. A real index would add to the value of the catalogue; the list given under the heading "Contents" is unsatisfactory. Every independent-telephone man will doubtless secure a copy of the new book.

The Western Electrical Supply company of St. Louis has issued a special catalogue—No. 16—of electric-railway supplies. The company carries a complete line of railway accessories in stock in St. Louis, and can ship at factory prices. The catalogue lists about everything an electric-railway manager needs outside of generating plant, trucks and cars and car equipments. It is supplied with an index and an alphabetical list of code words. Among these words the patriotic citizen will notice with satisfaction that the company has placed the names of Dewey, McKinley, Roosevelt, Sampson, Schley and Shafter. You telegraph for a Dewey, for instance, and you get a pole-climber. The catalogue is a convenient compendium of trade information for buyers.

The Central Electric company, Chicago, is proud of its new "Twentieth Century Encyclopædia of Electrical Supplies," and most justly so. "The Twentieth Century Encyclopædia" is the somewhat novel name adopted by the Central Electric company for its magnificent new catalogue, which will soon issue and which can be had if the name of the person desiring it, with the correct address, is forwarded. The company has been collecting material for this volume for about twelve months, and the work of compiling the catalogue has been under way since June. The book will contain about 512 pages, and, to use the words of Secretary Charles E. Brown, who is largely responsible for the "Twentieth Century Encyclopædia," it will be "up to date in every particular." The size of page will be 7¾ by 10¼ inches, and the book will be bound in a delicate olive-colored cover. It will have to be seen to be fully appreciated.

The many friends in St. Louis and throughout the Southwest of the Southern Electrical Supply company will be interested to note a change of organization in that institution. The business of the company will be carried on in future under E. Rubel as secretary and Charles E. Sharp as treasurer. Mr. Rubel will be remembered through his long, creditable connection with the St. Louis Electrical Supply company, and many of his friends will not be surprised at his identifying himself again with the interests of an electrical supply house. The present store of the Southern Electrical Supply company, at 11 South Seventh street, will be moved to a new location at 907 Market street. The new establishment will be one of three stories and a basement, it being the purpose of the company to treble its space in order to carry a very extensive St. Louis stock. It is now recognized that this is a most important feature of the success of a supply house. The company has also secured a number of new agencies.

BUSINESS.

The Central Electric company of Chicago, in addition to its regular large stock of all kinds of standard and special telephone wires, is carrying full stocks in all sizes of special tinned annunciator wire for telephone-switchboard work.

Huebel & Manger, makers of electrical and brass goods, at 286-290 Graham street, Brooklyn, have issued catalogue No. 4, devoted to bells, gongs, push-buttons, binding-posts, etc. The goods are neat in appearance and are claimed to be perfectly reliable. An improved water-tight push-button is described.

The Goubert Manufacturing company of New York city, manufacturer of the Goubert feed-water heater, states that it is at present exceedingly busy. The magnitude of modern steam plants is well exemplified by the fact that it has recently booked a number of orders for heaters of from 1,000 to 5,000 horse power.

The Electric Appliance company calls attention to its new self-contained automatic hook. This hook is exclusively the Electric Appliance company's design and manufacture, and a number of very strong claims are made for it. It is easy to install and occupies little space. It is put together complete and adjusted before shipping. The contacts are always visible upon opening the door, which makes it easy at any time to see that everything is in working order. The hook is constructed with a cam at the back to prevent the lever being bent back out of shape. This hook is apparently a desirable article.

The Western Electrical Supply company of St. Louis reports several very large sales in the week of the Adams-Bagnall arc lamp, for which it is exclusive selling agent in a number of states and territories. The new 100-hour alternating enclosed arc lamp of this company, which is now on the market, has received the highest praise from everyone who has used it or seen it. The Monarch incandescent lamp, exclusively handled by the Western Electrical Supply company of St. Louis, is keeping up its reputation as one of the best incandescent lamps upon the market, and it is claimed that, in some respects, it is superior to any other.

The Rockwood Manufacturing company of Indianapolis, Ind. reports that it has already experienced substantial proof of an improvement in trade, as the sales of its well known paper pulleys have considerably increased within the last few weeks. Some of the largest orders were secured from prominent concerns in the electrical field. The company has increased the manufacturing facilities of its factory and is very hopeful of still further extending its business. The Rockwood company has appointed Mr. John Child, 1563 Monadnock building, Chicago, as its agent in this city. Mr. Child is a popular member of the electrical fraternity, and the company is to be congratulated upon the selection of its representative.

The Leschen-Macomber-Whyte company of Chicago informs the trade that it has made arrangements to sell the celebrated Beacon bearing metal in the United States. This metal is made by W. N. Brunton & Son, Musselburgh, Scotland, who have had very extensive experience with metals. It is used largely in Great Britain, Germany, France and other countries, and it is believed that its excellent qualities will meet with substantial recognition in the United States. Beacon bearing metal is asserted to possess these advantages: It runs longer and cooler than any other metal, and consumes less lubricant. It does not score or injure the shaft. It is much more durable than any other bearing metal. It does not heat; always runs cool. It saves friction, power, money. It is the cheapest and best bearing metal in the market. Its melting point is about 530 degrees F., and its weight per cubic foot is 518 pounds.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued October 4, 1898.

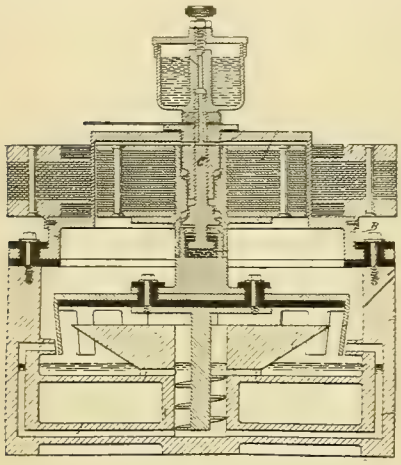
611,601. Electric Arc Lamp. Sigmund Bergmann, New York, N. Y. Application filed July 10, 1897.

An adjustable electrical resistance consists of a series of resistance coils arranged in one or more loops and a movable metallic clamp engaging the two portions of the loop and capable of adjustment along the loop, whereby a greater or less portion of the loop of resistance coils may be cut out of circuit.

611,638. Signal Apparatus. Harry G. Leopold, New York, N. Y. Application filed September 3, 1897.

This system contains the combination of a controller, a signaling circuit, a series of order signals located at a distance and in shunt relation to the circuit, a telltale device included in the circuit and located at the sending station, an open circuit around the controller, a recording device and a series of devices corresponding in number with the order signals and adapted to be actuated by the current traversing the signal circuit to close the open circuit around the controller and energize the recording device.

611,707. Electrical Connector. Joseph Pedriali, Brussels, Belgium. Application filed March 30, 1898.



NO. 611,719.

An electrical connector consisting of two parts, one of which is a handle of insulating material provided with a plug projecting therefrom and carrying at its extremity an enlargement or head, and the other consisting of a hollow plug of insulating material and containing a U-shaped spring, the extremities of which are provided with contact plates between and beyond which the head of the plug passes, the U-shaped spring being reinforced by other springs located each side thereof.

611,719. Electrical Circuit Controller. Nikola Tesla, New York, N. Y. Application filed December 10, 1897.

A device for making and breaking an electric circuit is described, comprising means for maintaining a jet or stream of conducting fluid which constitutes one terminal, a conductor or conductors making intermittent contact with the jet and constituting the other terminal, and a receptable inclosing and excluding oxygen from the terminals.

611,722. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Application filed January 10, 1898.

A pivot-supporting plate for use in electrical measuring instruments constructed of a single piece of metal having a tubular standard screw threaded exteriorly in combination with a pivot pin inserted in the standard and a screw-threaded nut adapted to bind or hold in position the index hand of the instrument and the conducting terminals of the coil to which the plate is secured.

611,723. Index Needle or Hand for Electrical Measuring Instruments. Edward Weston, Newark, N. J. Application filed January 10, 1898.

An index needle or hand having a counterbalancing arm and a permanent counterweight secured thereto, in combination with an adjustable counterweight carried by the arm.

611,724. Electrometer. Edward Weston, Newark, N. J. Application filed February 14, 1898.

An electrometer having its quadrants so arranged as to constitute a disk-like field, and a disk-like armature or needle sustained upon a pivot shaft and adapted to rotate in the field, in combination with a metallic casing surrounding all of the parts and insulated therefrom.

611,752. Trolley Ear. Henry Geisenhöner, Schenectady, N. Y. Application filed July 15, 1898.

A trolley ear which is secured to the trolley wire by compressing the metal forming the wire around the ear.

611,760. Surface-contact Railway System. William B. Potter, Schenectady, N. Y. Application filed November 29, 1897.

The first claim is given: In a surface-contact railway, a feeder, sectional conductors or studs arranged in two sets, one furnishing current to the motor, the other upon the negative side of the system, and electro-magnetic connecting switches, in combination with a moving vehicle carrying motors, sliding contacts upon the vehicle for each of the sets of sectional conductors, a testing contact in the line of the positive studs and in circuit with a circuit breaker upon the vehicle in the main motor lead, and a registering apparatus actuated by the circuit breaker.

611,766. Device for Suspending Arc Lamps. Joseph Borka, Buffalo, N. Y. Application filed March 4, 1898.

A device is described for suspending an electric lamp from a pole consisting of a plate removably secured to the pole, sockets integral with the plate, a cylindrical rod removably secured in such sockets, a pair of tubular supporting arms journaled upon the cylindrical rod outside of its sockets, a casing integral with the plate and between the sockets, a pulley journaled in such casing, a frame in which the outer ends of the tubular supporting arms are connected, a projecting lug integral with the frame, a pulley in such frame, a tie rod secured at one end to such frame and removably secured at its other end to the pole, and a cord passing over both pulleys for operating the suspended lamp.

611,778. Electric Railway. Justus B. Entz, Philadelphia, Pa. Application filed December 21, 1895.

A rotary transformer is employed having its alternating-current end adapted to develop the average power required for driving a motor car or locomotive and having its direct-current end connected with a storage battery which compensates for variations from the average load, a motor car or locomotive carrying the apparatus and having its driving wheels mechanically connected with the rotary transformer, power-station apparatus generating alternating current and having line or working circuit connections extending along the railway, means for supplying current from the line or working circuit to the alternating-current end of the transformer, and devices for including and excluding the rotary transformer in and from the line or working circuit, whereby the alternating current on the line or working circuit and on the power-station apparatus is kept uniform, thus permitting of the installation of the latter for the average load.

611,809. Electric Meter. Sydney Evershed, London, England. Application filed December 21, 1897.

In a motor meter a vertical axle of magnetic material is adapted to rotate with limited vertical play between upper and lower jewels or other stops, in combination with a magnet having one pole situated above the axle and adapted to provide a magnetic support and pivotal guidance to the axle.

611,820. Roadbed Construction. John H. Robertson, New York, N. Y. Application filed March 30, 1896.

The special feature of this arrangement is the provision for the electrical equipment of a conduit-trolley system.

611,821. Electric-railway Conduit and Trolley. John H. Robertson, New York, N. Y. Application filed October 20, 1896.

The combination with a box fixed to a car and a box frame having a laterally yielding connection with the box and provided with contact plates, of a trolley arm provided with yielding contact pieces and means for removably connecting the trolley arm with the yielding box frame, is described.

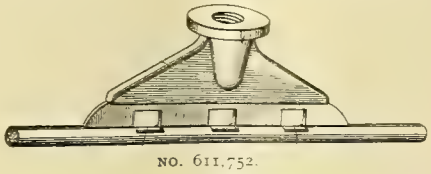
611,822. Electric Time Switch. Frederick M. Schmidt, James H. Gerry, and William S. Barstow, New York, N. Y. Application filed November 18, 1897.

A switch controls the supply of current and an electric self-winding clock energized from the supply circuit controls the operation of the switch to open and close the same.

611,850. Electromagnetic Engine. Peter B. Watson, Philadelphia, Pa. Application filed May 9, 1898.

The essential features of this engine include a battery, wires leading therefrom to binding posts, a switch adapted to contact with the binding posts, conductors leading from the switch to a plurality of magnets, the magnets being connected by conductors to each other, to the binding posts and to a cut-off, the latter having a lever pivotally mounted, contacts located on either side of the lever, a conductor leading from the contacts to the magnets, the latter being located in upper and lower compartments of an X-shaped frame and having their heels or ends arranged at an incline to each other, an oscillatory armature supported in the frame, the extremities of the armature being adapted to swing alternately toward the heels or ends of the magnets, a pin mounted in the lever of the cut-off, the pin engaging the walls of a slot in a pitman suitably supported, the pitman being actuated in unison with the armature, a pitman connecting the lower extremity of the armature with a crankshaft and a governor for the engine.

611,869. Automatic Switch Apparatus. Alfred Schlatter, Budapest, Austria-Hungary. Application filed September 21, 1897. Patented in Italy November 18, 1895, and in Hungary August 19, 1896.



NO. 611,752.

Switch apparatus for reducing the magnetizing work either of a single alternate-current transformer or the first member of a group of transformers consists of the combination with the transformer of a controlling or switch transformer arranged and operating in such a manner in conjunction with an electromaguet that the winding thereof is included alternately in the secondary circuit of the working transformer and in that of the switch transformer, according to the position of the armature lever of the electromagnet, and that on the inclusion of a consuming device the magnet attracts the armature lever and holds it during the duration of consumption.

611,894. Signaling. John P. Coleman, Edgewood Park, Pa. Application filed January 3, 1898.

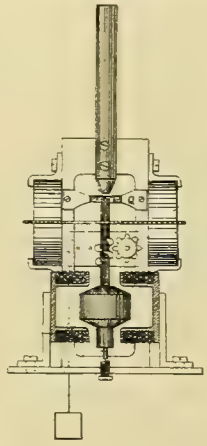
In a signaling apparatus, the combination of a signal having a bias to danger position, an electric motor having a detachable connection to the signal, a make-and-break mechanism in the motor circuit adapted to be opened by the signal as it approaches clear position, and a spring arranged to be placed under tension as the signal is cleared and operative on the release of the signal to impart an initial movement toward danger position.

611,897. Electric Signal Device for Railways. Louis T. Dubé, Paris, France. Application filed December 6, 1897.

An electric signal for railways consisting of rail sections overlapping one another, a series of electric conductors for each rail parallel thereto, the conductors overlapping their respective rails, electric batteries carried by each locomotive, each having an independent circuit formed through the rail and its respective conductor by means of trolley wheels carried by the locomotive engaging respectively with the rail and with the electric conductors, current-reversing mechanism and an electrically operated signal carried by each locomotive interposed in the same circuit, the other circuit being so arranged that the trolley wheels traveling in the same direction have a reverse polarity from those traveling in the opposite direction and an electrically operated signal carried by each locomotive and interposed in the circuit.

611,902. Apparatus for Adjusting Phases of Alternating Currents. Johannes H. F. Görges, Berlin, Germany. Application filed December 27, 1897. Patented in Germany August 13, 1896; in Switzerland January 18, 1897; in France March 3, 1897; in Austria April 4, 1897, and in Italy May 7, 1897.

The combination is claimed with a circuit for conveying alternating current, of a dynamo-electric machine adapted to be operated by magnetic effects differing in phase, a Wheatstone-bridge circuit connected with the circuit the dynamo-electric machine having a winding which is included in the bridge of the Wheatstone-bridge circuit and adjustable induction and resistance devices included in the branches of the Wheatstone bridge circuit.



NO. 611,809.

611,919. Telegraph Key. Frank E. Lewis, Jefferson, Texas. Application filed December 2, 1897.

A blank for telegraph keys comprising an annular base having oppositely and outwardly projecting arms with notches in their extremities, and a forwardly extending arm within the annular portion, the opposite extending arms adapted to be bent upward to form bearing posts for the key trunnions, and the inwardly extending arm adapted to be bent upward to form a spring.

611,927. Multiple-rate Metering System. Frederick T. McIntyre, Washington, D. C. Application filed March 25, 1898.

Two independent meters are used having their register-controlling elements connected in independent branches of the distributing mains, and independent control wires connecting the branches with the distant central or control station, and a switch mechanism is provided for completing the circuit through one or the other of the control wires and meter in circuit.

611,943. Railway Signaling. Jens G. Schreuder, Edgewood Park, Pa. Application filed January 3, 1898.

A motor is employed for shifting the signals, independent connections being made from the signals to the motor, a lock holding each signal in clear position, a magnet controlling each signal connection and lock and a track circuit controlling the circuits of the motor and of the controlling magnets.

611,970. Method of and Means for Controlling Energy Delivered to Translating Devices. Harry W. Leonard, East Orange, N. J. Application filed January 21, 1896.

The method of varying the electromotive force upon the terminals of a translating device consists in developing independently of the main source a divided electromotive force between two constant potentials and developing a variable electromotive force in another electromotive-force-producing device connected to the point of division of the divided electromotive force and also to one terminal of the translating device, the other terminal of the translating device being connected to one of the points of constant potential.

611,971. Electrical Wireman's Combined Gauge and Calculator. Herbert Lutz, Hamilton, Canada. Application filed February 28, 1898.

A combined wireman's gauge and calculator is described consisting of a plate upon the face of which is marked with a series of numbered spaces, indicating amperes, a smaller plate pivoted to the large one, having a series of marginal numbered spaces indicating running feet, and interior figures representing voltages, a pointer or indicator attached to the pivot pin to point to numbered voltages on the smaller plate, a corresponding pointer or gauge indicator attached to the rear or opposite end of the pivot pin, having its outer end formed eccentric shaped, a recess cut out of the rear side of the large plate for the eccentric to co-operate with to form a wire gauge, the size number of which is indicated by the indicator pointing to marginal figures cut on the rear margin of the large plate.

611,974. Automatic Switching and Telephone System. Lars G. Nilson, Sioux City, Ia. Application filed March 9, 1896.

In a box adapted to transmit electrical impulses a retarding appliance is employed consisting of a pivoted balance, projecting parts extending from a passing body and two slidable pallets adapted to be alternately moved by the projecting parts of the passing body.

DESIGN.

29,451. Electrical Instrument Case. Waldo A. Layman, St. Louis, Mo. Application filed July 14, 1898. Term of patent, 14 years.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, OCTOBER 22, 1898. No. 17

Complimentary Dinner to War Heroes of the Chicago Edison Company.

An enjoyable event appropriate to the Peace Jubilee season attracted a gathering of electrical men at the Grand Pacific Hotel, Chicago, on Saturday evening, October 15th. The occasion was a complimentary dinner given by Mr. Samuel Insull, president of the Chicago Edison company, to the members of that corporation's staff who had returned to Chicago after participating in the recent conflict with Spain.

At the outbreak of the war many employes of the Chicago Edison company tendered their services to the government and presented themselves for examination. The management of the company, while regretting the loss of their services even temporarily, showed appreciation of their patriotism by assuring them that their positions would be awaiting them on their return. Following is a list of those who entered the service from the ranks of the Chicago Edison company:

Ensign B. R. T. Collins, Scorpion.
S. H. McEwen, gunner's mate, Oregon.
Thomas Roberts, gunner's mate, Oregon.
A. Montgomery, gunner's mate, Oregon.
W. B. Tullock, water tender, Suwannee.
John Miller, machinist, Newark.
Joseph Goldsmith, machinist, Oregon.
T. A. Cressey, bugler, Cincinnati.
Lieut. A. C. Parsons, U. S. N., Washington.
H. Kenney, private, Seventh Regiment.
A. J. Morgan, bugler, First Regiment.
E. C. Colby, quartermaster's sergeant Second Regiment.
J. Fitzsimmons, private, First Regiment.
J. B. Kempter, private, Second Regiment.
William Cleff, first sergeant, First Regiment.
S. A. Rutherford, sergeant, Engineer Corps, First Regiment.

Of these several have not yet been mustered out of service; others are in the hospital, and a few are considering the advisability of remaining in the service. At the dinner on Saturday evening Ensign Collins, Messrs. McEwen, Roberts, Montgomery, Tullock, Miller, Goldsmith, Kenney and Fitzsimmons were present. They occupied places at the speaker's table on the right of President Insull, who presided. On the left of President Insull were the invited guests. At the other tables were seated the members of the Chicago Edison club. Following is a list of those who were present:

Samuel Insull.
F. S. Gorton.
W. A. Fox.
E. J. Doyle.
W. H. Collins.
D. J. Doherty.
F. E. Baker.
W. H. Fairclough.
H. M. Mills.
F. Sargent.
R. L. Elliott.
L. A. Ferguson.
J. J. Abbott.
George H. Lukes.
E. A. Edkins.
Merrick Shawe.
W. A. Bentley.
E. J. Fowler.
E. F. Smith.
B. Jamieson.
H. A. Seward.
C. G. Y. King.
T. H. Creden.
George H. Jones.
J. H. Goehst.
H. E. Niesz.
D. R. Hoffman.
J. E. Boland.
D. B. Bronson.
Charles H. Stewart.
H. D. Babbitt.
H. L. Gannett.
W. M. Melody.
W. R. Irving.
R. C. P Holmes.
John W. Ferguson.
L. S. Hills.
H. Jampolis.
George B. Johnson.
W. H. McClain.
E. H. Niesz.
George Tailleur.
Clyde V. Strohm.
B. E. Strohm.
G B. Springer.
J. Counsell.
W. M. Anthony.
A. E. Mosier.
J. E. English.
H. E. Addenbrooke.
G. E Burns.
R. W. Waite.
W. M. Crane.
W. J. Dooner.
C. H. Russell.
F. Byrne.
A. T. Bacon.
George E. Fertig.
W. F. Holland.
H. B. Goodwin.
George Howell.
H. F. Frosch.
C. A. Harding.
W. H. Fairclough, Jr.
E. K. Rigby.
E. Reed.
W. Devine
C. Marden.
H. Phillips.
F. Forest.
E. Schuettge.
James Driver.
John F. Gilchrist.
S. M. Bushnell.
E. W. Lloyd.
Earl Russell.
O. R. Houge.
J. W. Cheney.
Charles F. Clark.
W. L. Abbott.
C. A. Lind.
George Brodie.
George Smail.
B. Southwell.
T. H. Jenkins.
W. D. Johnston.
E. H. Noyes.
Thomas Richards.
W. T. Wardel.
G. S. Box.
J. Hughes.
F. Borg.
P. McDermott.
T. E. Jones.
Thomas Jones.
A. Thierault.
W. F. Healy.
Frank Lynch.
James Doyle.
T. O. Barter.
M. A. Himrod.
O. J. Bushnell.
J. H. Perry.
F. R. Jenkins.
W. H. Pierce.
H. B. Gear.
T. P. Gaylord.
F. V. Sackett.
H. G. West.
E. O. Schweitzer.
W. B. Bull.
C. L Davidson.
Stephen Gardner.
P. Junkersfeld.
Edward Schildhauer.
George Leary.
W. D. Morrison.
C. G. Atkins.
T. Christian.
W. J. Manning.
A. T. Walcott.
J. Thulin.
A. G. Anderson.
J. A. Radford.
P. F. Williams.
W. B. McDonald.
W. L. Githens.
E. D. Alexander.
E. Roberts.
P. J. Smith.
H. G. Bowles.
J. J. Schayer.
J. B. Cowan.

GUESTS.

Joseph Leiter.
John B. O'Hara.
M. J. Insull.
F. S. Peabody.
E. H. Cheney.
R. W. Francis.
John Collins.
Eugene H. Lewis.
F. J. Baker.
Lieut. S. D. Flood.

COMPLIMENTARY DINNER TO WAR HEROES OF THE CHICAGO EDISON COMPANY.

The dining-room had been appropriately decorated for the occasion, the principal feature being Ameri-

can flags, artistically grouped about clusters of incandescent lamps. The most striking feature of the decorations was a handsome American flag worked out in small incandescent lamps, suspended behind the speakers' table, which stretched across the room and from which the other tables extended.

When the company had assembled Ensign Collins and his men marched in. They were greeted with cheers from their old associates, and as they reached the head of the table current was turned on the flag composed of incandescent lamps, and it flashed a greeting to the boys who had fought so valiantly to uphold its honor.

During the evening music was furnished by an orchestra, and after the dinner speeches were made and several excellent musical selections presented. The entertainment was provided by members of the Chicago Edison club.

President Insull, in the course of his remarks, contrasted the brilliant achievement of Dewey at Manila with the celebrated victory of Nelson in the battle of the Nile a hundred years before. He felt a peculiar gratification in the reflection that the orders for the destruction of Montejo's fleet were given in the same language that directed the movements of the English against the French. Again, the orders to advance on Santiago and the charge at San Juan were given in the same tongue as those at Balaclava and Khartoum. It was natural that an Englishman born and an American by adoption should exult over these evidences of the superiority of English-speaking nations.

Mr. Insull introduced Ensign Collins, who gave an interesting account of his experiences. He exhibited several relics of the war.

Lieutenant Flood also related some anecdotes and spoke particularly of the part taken by the Illinois Naval Reserves, which made such a creditable record.

Mr. McEwen's account of the work of the Oregon was listened to with marked attention.

At the conclusion of the evening's exercises a vote of thanks was tendered Mr. Insull for the entertainment. Following is the programme:

PROGRAMME.

Our Guests of Honor.....Mr. Samuel Insull
Danube Waves.....Chicago Edison Mandolin Club
The Fighting Scorpion.....Ensign B. R. T. Collins, U. S. N.
Baritone Solo.....Mr. Edward H. Niesz
Musical Melange.....Mr. Henry Frosch
The Oregon Before Santiago.....Mr. Samuel H. McEwen
The Sailor's Hornpipe.....Master James Brodie
Coster Songs.....Mr. Walter Bull
Selections.....Chicago Edison Quartette
(a) Battle Hymn of the Republic.
(b) When Johnny Comes Marching Home.
Comic Song.....Mr. William Irving
Pickaninnies' Cake Walk.....{ Master James Brodie / Master Willie Stokes

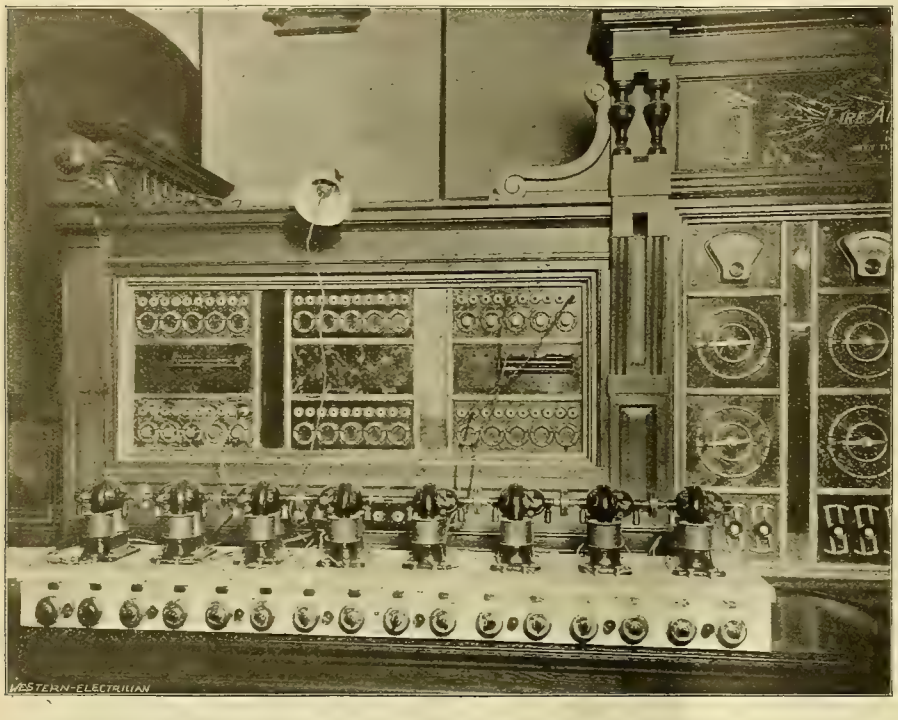
"A Perfect Blaze of Electric Glory."

A Pittsburg correspondent, writing of the electrical illumination in that city in honor of the triennial conclave of Knights Templars, says: "The brilliancy of the street decorations marks an epoch in the history of electric illuminating. Within a radius of four blocks from the heart of the city 400,000 [?] incandescent lamps burn every night. Huge crosses and other emblems of templarism are suspended on the sides and fronts of the city's tallest buildings, and there is hardly a store or shop in the downtown district which has not an illuminated design of some Masonic significance. The result at night is that Pittsburg presents a perfect blaze of electric glory."

Motor-generators for Chicago Fire-alarm Circuits.

The illustration presented herewith shows an improvement devised by City Electrician Ellicott of Chicago for the purpose of supplying current to the fire-alarm circuits of the city. The eight small machines shown mounted on the marble slab in front of the fire-alarm switchboard, and connected with it and also with a source of 110-volt current, consist of two motors and six generators, arranged in two sets—one motor driving three generators. The combination is designed to be used in connection with storage batteries for the fire-alarm circuits, and the extremely particular and important service demanded that unusual care be used in the general plan and in the smallest detail.

Unless the facts are especially called to attention, one does not realize the extent and importance of the electric fire-alarm service of a city like Chicago. When the help of the firemen is needed the unobtrusive little red box at the street corner is a friend indeed; and there are over 1,250 of these alarm boxes, always ready to signal the cry for help, scattered over the area of Chicago. The record of alarms sent and received last year gives a total of 6,599, and there was not a failure or delayed alarm. The city electrician's annual report for 1897 shows



MOTOR GENERATORS FOR CHICAGO FIRE-ALARM CIRCUITS

that, of 1,248 fire-alarm boxes, all but 279 were brought into service at least once during the year, and some of them many times. Box No. 325, located at Halsted and Fourteenth streets, was used 47 times to indicate fire. The value of the system at the present time is $621,704.64. Of this amount $244,646.69 is invested in underground and overhead circuits.

In the general plan of construction of the new motor-generator combination a 110-volt shunt-wound motor is mounted on a marble base, and in line with it are mounted three generators, connected together, and to the motor. The motor has a double-pole switch in both armature and field circuits and an adjustable rheostat in the fields, to admit of a wider range of speed.

Each of the three generators of each set has a double-pole switch in both armature and field circuits and an adjustable rheostat in the fields, in order that the voltage of each generator may be varied independent of the others. The fields of the generators are separately excited, insuring quick and positive action when the armature circuit is closed; the armatures of the relays do not show any perceptible lag during the rapid opening and closing of the circuit.

The details of the apparatus are carefully worked out, and the machines, which were made by the Western Electric company, are as carefully built, with all the important features, as large generators and motors. The pole-pieces are of cast-steel, fitted to a substantial iron base made adjustable to insure alignment. The armatures are built up and laminated; the windings are of the "iron-clad" type, there being no wire on the surface of the armature, and no band wires are used. The commutators are of copper insulated with mica; carbon brushes are used, and the bearings are self-aligning and self-oiling. Each unit is completely insulated from the others by means of the marble base and insulated couplings. It is of extreme importance that there be no chance for a cross between the armature circuit of one generator and that of another, for in such a case grounds on the line might cut out some of boxes and make it impossible to turn in an alarm from them.

The two sets of motors and generators described are designed to furnish current as follows: Three generators at 40 volts and .06 of an ampere, two generators at 70 volts and .06 of an ampere and one generator at 100 volts and .10 of an ampere. They will be used as an auxiliary to the storage batteries and as a relay while part of the storage batteries are being recharged.

The connection of the motors and generators of the set, by friction clutches on the shaft, is such that either one of the motors can drive any or all generators. Any generator may be cut out for examination or repair without interruption of the service.

Patent Law Association of Chicago.

Chicago sustains an important relation to the Patent Office at Washington and to the courts which pass upon patent rights and patent law. It has the oldest and practically the only society of patent attorneys in the country. In fact the Patent Law association of Chicago is the only association of patent lawyers in the United States that has existed for three consecutive years. Several similar associations have been organized in Washington, but none of them has successfully preserved its identity for any considerable length of time. Frequent attempts have been made by the officers of the Chicago society to promote sister organizations in New York, Boston and Washington, but the relations of the members of the patent bars in those cities are so far from being cordial that these efforts, as well as the efforts of individual members of the New York and Boston bars, have been unavailing. The espirit de corps of the Chicago patent lawyers shows well by contrast.

The Patent Law association of Chicago was organized in November, 1884, in the office of Mr. James H. Raymond in the old Honore Block, by Mr. George Payson, then general counsel for the Western Railroad association, and Hon. L. L. Bond. The first president was Mr. Bond, and Mr. Raymond was the first secretary and treasurer. The society has enjoyed a continuous and successful existence from that time until this. It has 79 members, whose purpose it is to discuss matters of particular interest to patent attorneys, to promote salutary legislation relating to the Patent Office and the practice in the courts and to encourage harmony, good fellowship and social intercourse. The association has an annual dinner in October which is attended by all the federal judges of Chicago, and usually meets two or three times during the year beside, usually at the Union League club. It is the custom for the members to meet at dinner and afterward listen to the reading of a paper on a subject previously assigned. The present officers are Taylor E. Brown, president, and J. W. Dyrenforth, secretary and treasurer. They, with R. H. Parkinson, J. L. Jackson, C. C. Poole, George P. Barton and W. H. Chamberlain, constitute the board of managers. The names of the members of the association, arranged alphabetically, are as follows:

A. H. Adams.
Edmund Adcock
Ephraim Banning.
T. A. Banning.
L. L. Bond.
Jesse A. Baldwin.
W. S. Bates.
T. E. Brown.
Frank T. Brown.
H. Bitner.
George P. Barton.
E. H. Bottum, Milwaukee.
C. A. Brown.
O. R. Barnett.
W. O. Belt.
C. C. Bulkley.
L. L. Coburn.
George H. Christy, Pittsburg.
W. H. Chamberlain.
D. M Carter.
H. W. Carter.
D. B. Cheever.
C. K. Chamberlin.
J. L. Cragg.
P. C. Dyrenforth.
W. H. Dyrenforth.
J. W. Dyrenforth.
Douglas Dyrenforth.
M. E. Dayton.
S. E. Darby.
John G. Elliott.
George P. Fisher, Jr.
D. H. Fletcher.
N. C. Gridley.
Fred Gerlach.
L. K. Gilson.
A. H. Graves.
Lysander Hill.
Charles S. Hill.
L. M. Hopkins.
Frank A. Hopkins.
John W. Hill.
S. E. Hibben.
J. L. Jackson.
W. Clyde Jones.
Cyrus Kehr.
C. C. Linthicum.
V. H. Lockwood, Indianapolis.
R. S. Ludington.
J. H. Lee.
J. W. Munday.
L. L. Morrison, Rockford, Ill.
A. Morsell, Milwaukee.
J. H. McElroy.
Charles F. Miller, Canton, O.
J. McRoberts.
C. K. Offield.
W. R. Omohundro.
J. H. Peirce.
C. C. Poole.
F. W. Parker.
C. E. Pickard.
R. H. Parkinson.
Charles G. Page.
George S Prindle, Washington, D. C.
A. C. Paul, Minneapolis.
J. H. Raymond.
William A. Redding, New York.
Edward Rector.
W. R. Rummler.
T. F. Sheridan.
Paul Synnestvedt.
H. S. Towle.
F. D. Thomason.
H. G. Underwood, Milwaukee
E. A. West.
J. H. Whipple.
George E. Waldo.
Robert H. Wiles.

Lightning Struck the Jackpot.

[From the New York Sun.]

Parkersburg, W. Va., October 9.—While four men were playing a game of poker yesterday afternoon under a cliff near Creston, using a huge, flat-topped stone for a table, a heavy, black cloud loomed up over the hill. The men failed to notice the approaching storm. Suddenly a crash of thunder pealed and a lightning bolt struck the rock on which a jackpot lay, splintering the rock and scattering money and players. None of the men was hurt seriously, and after they recovered from the shock the money was found. The bolt broke up the game.

In the Electrical Repair Shop.

Home made Jack Screw

Fig. 1 is a drawing of a home-made device for getting steel shafts apart, which furnishes a better way than the use of pinch bars. It is simple and easy to handle, but it must be very strong. You clamp it on the shaft and unscrew the nut on the inside of the clamp and it will force the pieces apart. Take two pieces of iron or steel, six or eight inches long, one by 1½ inches square, cut a slot in one end of each of them so that the bearing of the roll will fit in it loose; then drill a hole in the other end of each large enough to receive a good, strong bolt, say one-half inch. A shows one of the pieces ready to use. The expanding bolt is D and the lower brace E. F shows the device in position to use. Two wrenches can be used to tighten, and if the joint of the shaft is in the slot, it will bring it apart without breaking or battering it. If you cannot get a jack made, use a piece of copper against the joint, striking it with a hammer or mallet.

Cutting Tools.

In keeping in order cutting tools such as are used for repair service in the electrical shop work, it is a good plan to have a piece of cast-iron or steel made in the form of a disk with the edge at an angle of five per cent. to the base and about two inches in height. This will be found a useful article on which to file tools. When a tool is taken from the forge be sure and file the bottom or bearing straight first; then, placing the template or planer bed, file the tool to the same angle. Tools will, of course, stand greater strain the less the angle; still they must clear, and five per cent. will be ample.

Aluminum Connections.

Aluminum connections and wood frames are now in use in some of the lighter forms of electrical apparatus. Several different forms of head-lugs were experimented with by the writer before a reliable kind was found. In each style the head-piece is brazed to the seat. That in Fig. 2 is shown with the wood butt in position and provided with a rivet or pin A, which is headed upon either side of the tube. This pattern was improved upon by using threaded sleeves C, into which sleeve screws B B are put from top and bottom of tube. With the sleeved pattern of connection at the head lug, the strength tests of the frame register higher than when simple rivets or pins were used.

Useful for Winding.

A little machine for measuring wire while winding can be made with a few tools. The device is attached by means of screws through a plate to a stand and consists of a "temple," 2¼ inches in circumference, from which runs a miniature worm shaft. The worm on this shaft runs in the teeth or cogs of a small gear. There are 92 cogs in this gear, and each revolution of the "temple" makes an advance of one cog. Four revolutions of the "temple" make an advance of four teeth on the cog gear. This makes nine inches, or a quarter of a yard. In the center of the cog is a smaller gear, which is connected by a dial gear by cogs or teeth, and this is what does the registering. On the face of the dial gear figures may be cut representing a quarter, half, three-quarters, and from one to 48 yards. The "temple" should have several small pins on the surface of its circumference, which project just sufficiently to catch the edge of the wire. As the wire moves the "temple" slowly revolves, and, in doing so, turns the cog gear by means of the worm on the miniature shaft, and this in turn moves the dial by means of the central gear, and, by so doing, registers the quarters, halves, three-quarters and yards of wire as fast as it is wound.

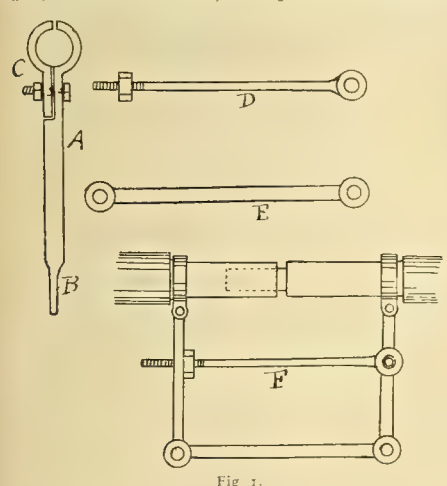


Fig 1.

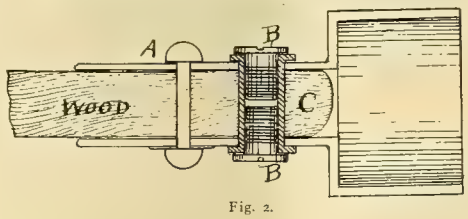


Fig. 2.

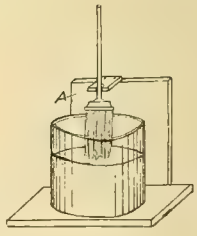


Fig. 3.

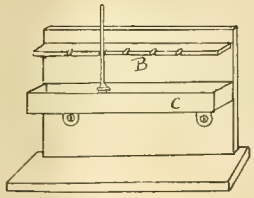


Fig. 4.

IN THE ELECTRICAL REPAIR SHOP.

Varnishing Room.

The varnish and paint room of the electrical repair shop is quite important, for the reason that the varnishings and staining required on electrical apparatus must be well done. The drying oil that is used is not always understood. The first essential is the film produced by the oxidation of a thin layer of drying oil or by the evaporation of the liquid vehicle from a gummy solution deposited on a surface by means of the brush. In order to keep the brushes in good condition for this work, I use a glass jar and water, as in Fig. 3. A little wood clip A holds the brush in place. A method for smaller brushes is shown in Fig. 4. The water is contained in the sheet-tin tank C and the brushes in holes bored and slotted in the piece B. The film which it is necessary to deposit on the object is a fibrous tissue so interwoven as to render it cohesive, and, in some cases, easily detachable, as, for instance, a film of collodion varnish applied on a surface. While the film produced by collodion varnish and pyroxiline is removable as a film from a solid surface, the linseed-oil film is removable only when produced on a liquid or a semi-liquid surface or on a surface that has been coated with a non-drying fat.

Referring now to the top colors, if used, three classes of materials are found in the market—pure white lead in oil ready-mixed, liquid paints, and various combination paints in paste form. The liquid paints are sold ready for use. The other two require the addition of oil, while the lead generally needs also a certain proportion of turpentine. Under certain conditions pure lead is not always suitable. First, it darkens rapidly in the presence of sulphurous gases; second, it is not, comparatively, a durable pigment, having a tendency to saponify the oil with which it is combined and to crumble from the surface. On general principles the combination paints are preferable. They commonly contain enough zinc to insure reasonable permanence of color, and an oil-carrying capacity high enough to guard against crumbling. The lead they contain is sufficiently diluted to have little effect on the oil, and the larger proportion of oil protects the lead from the action of discoloring gases.

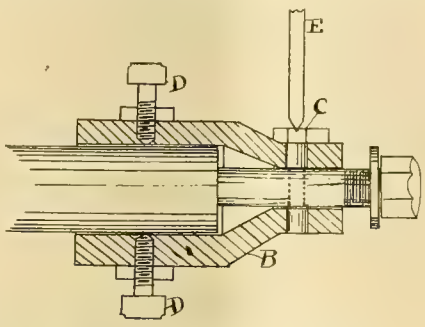


FIG. 5. IN THE ELECTRICAL REPAIR SHOP.

Belt Bands.

Bands for use in connection with grooved wheels should be well made. I am now making bands from No. 8 hank roving, using eight strands, and we make what we call a core band, using eight threads of No. 30 yarn. Whether that has any advantage or not, I am not prepared to say, although I think it has. I make the band very soft, not hard-twisted, being particular not to get too much tension on the band. We have a testing scale that we test with, which is used frequently.

For Round Shaft Keys

Fig. 5 shows a good method for drilling transverse holes through shafts for key seats. Cylinder B is provided with a guide hole C, the neck of which is about one inch deep, and this furnishes a guide for the drill E. The cylinder is furnished with screws D, and these hold the cylinder to the proper place during the drilling. A machinist can make this labor-saving instrument from tool steel. F.

A French company has secured a concession from the Venezuelan government to construct an electric railway line 43½ miles in length, to connect Cumana and Cumanacao. Power is to be generated by the waterfalls of the mountain streams. The company has sent engineers to Cumana to begin the survey.

Coast Signal Service in War time.

[From the New York Tribune.]

One of the most notable achievements of the navy at the outbreak of hostilities with Spain, which elicited the unbounded admiration of European military men, was the apparently marvelous establishment of a thorough system of communication along the whole coast between the inner line of naval defense and the outer army line of coast defense, which sprang into effective operation almost in a single day where nothing of the kind had ever existed in America.

This was accomplished by Captain Caspar F. Goodrich, at the time president of the Naval War College. He began his preparations on March 15th. Less than a month later he announced that he was ready to put his plans in operation, but it was not until war had become inevitable, until the Spanish fleet was well on its way to Cuba, and until the Atlantic seaboard was thoroughly alarmed over the possibility of a sudden raid from the sea, that he was permitted to incur the expense. Finally, on April 22d, the day the president proclaimed the Cuban blockade, he was permitted to send this telegram to the commanders of the naval militia of the seaboard states, from Massachusetts to Louisiana:

"Establish and man coast signal stations already determined by me. Lowest bids, greatest economy, most speed, necessary. Let crews sign temporary agreement, pending receipt of enlistment forms. No heliographs needed. Send further communications to superintendent, New York."

The following day he was ordered to sea in command of the St. Louis. Captain Kane took Captain Goodrich's place temporarily until May 9th, when he was relieved by Captain John R. Bartlett, retired, then, as now, chief intelligence officer of the navy, and to the latter officer is due the credit of having built up the coast signal service until its invaluable features are likely to become permanent in the scheme of national defense.

Captain Bartlett has just made a report upon the service to the secretary of the navy, which gives an interesting insight into the workings of the service and has some useful recommendations for the future. From this report the most interesting portions are here extracted:

"Within 24 hours from the time that Captain Goodrich sent the telegram above quoted, the men had proceeded to the points designated as locations for signal stations, and had reported. They were, for the most part, equipped with signal gear belonging to the various states, and took with them tents and camp outfits, with which they established temporary quarters. As rapidly as possible the shelter houses and apparatus ordered in accordance with Captain Goodrich's instructions were forwarded, so that in a week from that time all the stations, except those at the most outlying points, were fully established and equipped.

"This preliminary organization, when complete, contained eight (instead of seven) districts in which were distributed 36 signal stations, officered and manned entirely from the state naval militias, which contributed the following quotas, viz.:

States.	Officers.	Men.
Massachusetts	2	41
Rhode Island	..	5
New York	4	25
New Jersey	..	5
Pennsylvania	..	5
Virginia	2	5
North Carolina	..	23
South Carolina	3	20
Georgia	..	10
Florida	5	52
Louisiana	2	59
Totals	18	210

"The equipment furnished the stations consisted of international code flags and books, 'wigwag' flags, 'shapes' (cones and drums), powerful telescopes and binoculars, and (for night use) torches and an improvised 'Ardois' system of red and white lights. No pigeon cotes were provided, as the vessels with which it was designed to communicate were not furnished with carrier-pigeon outfits. At each station quarters were built for the crew and a 90-foot mast erected, carrying a 40-foot yard. In some instances signal towers were built.

"Each station was provided with a telegraph or telephone outfit, or with both. In most cases the stations were 'looped' into the Life-saving Service lines, which ran along the beach.

"The crews of the stations consisted of one chief quartermaster, three quartermasters of the second class and one landsman. At several of the most important points an extra telegraph operator, rated as quartermaster of the second class, was allowed. The men were divided into watches and armed with Springfield rifles, and a daily and weekly 'routine of exercise and drill' was issued, the manner of the performance of which was entered in the log. An inspection of the stations in each district was made once in every two weeks by the officer in charge, who reported to headquarters.

"The necessity of covering the long stretches of coast between these isolated stations was at once apparent, and the value of the co-operation of the Life-saving Service and the United States Lighthouse and Weather Bureau systems became self-evident. The crews of the Life-saving Service for 10 months in the year (August to May) constantly patrol the beaches from Maine to Texas, and no

vessel can approach within sight of the coast and escape their attention, while the lighthouse keepers and observers of the Weather Bureau have exceptional facilities for noting the approach of ships. The stations of the Coast Signal Service were forthwith connected with the general telegraph and telephone systems of the country, and with the Life-saving Service telephone lines that link together their stations along the coast.

"When the arrangements had been completed the observing powers of the 210 naval militiamen at the 36 stations of the Coast Signal Service were reinforced by the watchful crews of the life-saving stations, including 1,443 men, th alert light keepers in the lighthouses, numbering 850 men, and the personnel of the Weather Bureau, a total number of 33 observers. Thus an aggregate of 2,536 men were on the lookout for the approach of an enemy's vessel or a suspicious craft of any sort, and ready to report the movements of the vessels belonging to our own forces, including all the auxiliary ships and transports.

"Tests of the wires were made at the beginning of each watch, and a daily telegram was sent from each station to the district headquarters, and from there to these headquarters, using a cipher word which indicated that all at the station were well and present for duty, and that the station and its equipment and telegraph lines were in good order. Arrangements were made with all the companies to give the Coast Signal Service the right of way over their wires, and uninterrupted and direct communication could be had by notifying the company in advance. Actual trials proved that it did not take more than half an hour to clear the wires and get direct communication from these headquarters to Jacksonville or Miami, Fla. Arrangements were also made to send notice direct for each district headquarters to officers of the auxiliary naval force and the principal forts and batteries in the district of the presence of an enemy, the sighting of a suspicious vessel or any other information of a character which might be of importance to them. This saved the loss of time which would be necessitated by transmission through these headquarters.

"From the practical operation of the Coast Signal Service for three months I am confident that it would have served the use for which it was established—to observe and report the approach of an enemy's vessels. It frequently served an excellent purpose in keeping the Navy Department advised of the movements of United States vessels and was particularly serviceable in several instances, such as the reporting to and putting the department in direct communication with the United States ship Oregon after her long run from the Pacific, and while the whole country was anxious for news of her, also in reporting the United States ship San Francisco, when that vessel needed assistance and quick correspondence with Washington was of the utmost importance. It was also useful in keeping the various navy yards advised of the approach of vessels, thus giving them advance notice of their arrival, and, in many cases, several hours in which to make preparation for their reception. Some of the stations were able to render valuable assistance to the quartermaster's department of the army, in keeping in close touch with the hospital and supply ships and transports and by transmitting messages to them while they were in the offing.

"Perhaps, however, the most valuable result of the service has been the determination of those points at which signal stations are necessary in order to supplement in time of war the system of the Life-saving Service, Lighthouse Service and the Weather Bureau (which are the existing means of observing the movements of vessels in time of peace), and in perfecting the training of a large number of men outside of the navy in the transmission of information by signals under the conditions that prevail on the water, so as to make a complete, continuous service, covering every mile of the coast from the most easterly point of Maine to the most westerly point of Texas. We now know where to find officers and men to man these stations promptly and competently. The land for them (where not already owned by the government) can be easily acquired or controlled for future use, and the men ought to be kept together as a part of a United States naval reserve, the ranks of which should be constantly increased by the admission of those who are found qualified to perform the duties.

"The result of my experience leads me to believe that the Coast Signal Service should be an integral part of a naval coast-defense system, as it is most intimately connected with it, and should be in closer relation than that of an allied branch; also that the personnel of this service can be entirely furnished by the men who have been trained in the state naval militias. They have proved in our recent experiment well disciplined, trustworthy, competent and zealous, and I can speak in the highest terms of the officers and naval militiamen who entered the Coast Signal Service."

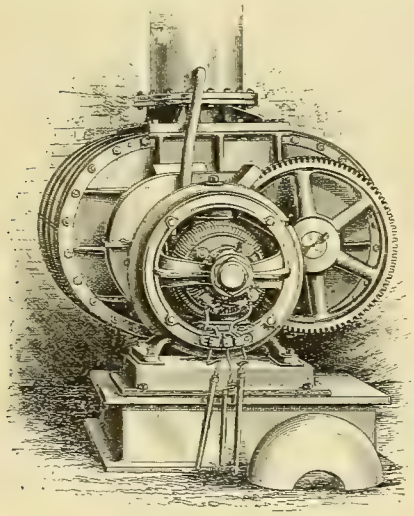


FIG. 1. ELECTRICALLY OPERATED FOUNDRY.—MOTOR-DRIVEN PRESSURE BLOWER.

Electrically Operated Foundry.

An interesting electrical plant of recent installation is that put in place in the foundry of the Reading (Pa.) Car Wheel company, which now owns what is said to be the first foundry in the world to be equipped for electrical operation. The adoption of electricity for motive power was due to a belief that it would prove to be economical in cost and much more convenient than steam. The current is taken from the mains of the city lighting plant, and the service has so far been very satisfactory. The system covers all appliances which can be run by power, and is very complete.

In Fig. 1 is shown a positive-pressure blower, with a special cast-iron sub-base and directly geared by a rawhide gear to a 35 horse power motor. In the illustration the motor is shown with the casing removed, but when in operation the working parts of the motor are entirely covered up. Several times when the bottom of the cupola has been dropped the motor has been spattered with molten iron, but not the slightest trouble has been experienced on that account.

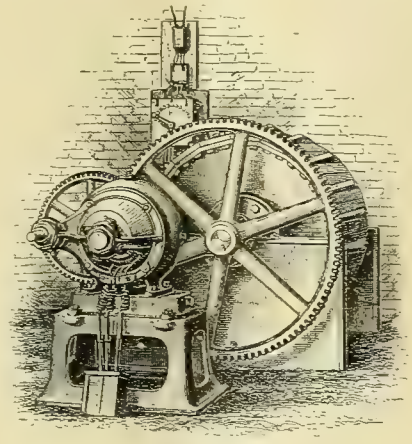


FIG. 2. ELECTRICALLY OPERATED FOUNDRY.—MOTOR-DRIVEN TUMBLING BARREL.

Fig. 2 shows the tumbling barrel, also directly connected to a back-geared motor, and used to separate the scrap iron and dirt coming from the cupola. In the cupola-charging room, which is directly over the testing room, are located the motors for driving the elevator and the drop for breaking old car wheels. These motors are equipped with regular reversing elevator controllers and are direct-connected to the elevator mechanisms. The elevator has a capacity of three tons and the break-drop has a weight of 2,000 pounds and a fall of 40 feet.

The casting and cleaning department has an area of 150 by 80 feet. The molds are arranged in rows or floors lengthwise of the building, each row or floor accommodating 20 molds. There are 10 floors, presenting a capacity of 200 car wheels per day. In the front part of the building and running at right angles with the floors is a track on which the ladle carriers run. These carriers are of iron and carry the small ladles, which have a capacity of about 800 pounds each, to the floors. The small ladles are operated by a small motor, which can be run by the man in charge of the large pouring ladle.

A large electrically operated ladle, with a capacity of about five tons, is shown in Fig. 3. It is mounted on trunnions and turned by the motor seen in the rear. The small ladles are carried to the front of the larger one and each filled in turn and carried to the different floors. Over each floor is a track on which runs a small iron carriage. The carriage carries a steel cable, to which is attached an iron hook for lifting the ladles. There is also attached a cable for drawing the carriage back and forth over the floors.

At the rear end of the building are located the motors for operating the system over the floors. The motors are seen in Fig. 4. There are two motors for each floor, one for operating the carriage, the other for the hoist. The motors were all built especially for the work they are required to do, and for the location, which required that they should be dust and heat-proof. The temperature in their vicinity often exceeds 150 degrees, but they do not give the slightest degree of trouble. They are all reversing and equipped with controllers for reversing and varying speed. From each controller is run a hand rope to the floor, so that each molder has perfect control of the speed and can vary it from one to 50 feet a minute on the hoist. Each hoisting motor is also equipped with an electric brake, which stops it instantly when the current is shut off and also controls the lowering speed.

Directly under the motors and at right angles with the floors are the pits for annealing. There are three rows of pits, 20 pits in each. These pits, which are slightly larger than a car wheel, are line with firebrick and have each a capacity for accommodating 18 wheels. Leaving the molds the wheels are carried along to the pits, in which they are placed by pitting cranes while still red hot. They are allowed to remain here several days for gradual cooling. Over each row of pits is a pack on which runs a carriage precisely similar to those running over the floors, and operated by motors in the same way.

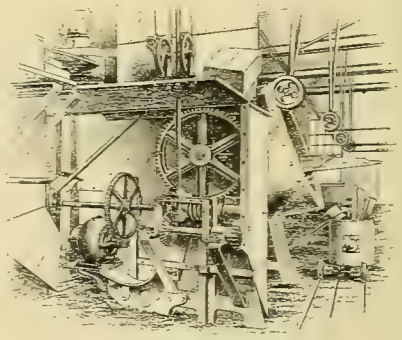


FIG. 3 ELECTRICALLY OPERATED FOUNDRY — FIVE-TON LADLE ELECTRICALLY TURNED.

The current is distributed on the three-wire system. The motors are of 220 volts capacity, and are connected to the two outside wires. The plant has proved to be remarkably economical in operation, and the superintendent of the company, Mr. Coleman, states that the running expenses have been much less than those of a similar plant operated by steam. The illustrations and facts for this article are taken from the Iron Age.

Western Union Report.

The annual report of the Western Union Telegraph company shows that the company earned for the fiscal year ended June 30, 1898, $5,183,605 above interest charges and sinking-fund requirements, amounting to 5⅓ per cent. on the capital stock. Dividends are paid at the rate of five per cent., the balance for surplus being $315,000. This is a remarkable improvement over the showing for the year 1896-97, when the surplus amounted to only $3,487. The revenues from business amounted to $23,915,000, an increase of $1,276,000, or about 5½ per cent. over 1896-97. A heavy increase in expenses reduced the increase in net earnings to $357,000.

The significance of this disproportionate increase in operating expenses is that the added business incident to the recent war was not of the most profitable character. President Eckert, touching this subject in his annual report, stated that the reported decrease in the average tolls received and increase in the average cost per message were accounted for by the large number of government and press messages consequent upon the war with Spain transmitted during the latter part of the fiscal year, on both of which classes of messages the tolls are the lowest, although the highest grade of operating service has to be employed for their efficient transmission.

In the year $10,000 bonds, due March 1, 1900, were redeemed by the sinking-fund trustees, and $14,000 five per cent. collateral trust bonds, due January 1, 1938, were issued in exchange for a corresponding amount of the capital stock of the Gold and Stock Telegraph company, upon which, under the lease of the company, interest was being paid at the rate of six per cent. per annum. President Eckert explained that the decrease of 767 miles of poles as compared with the preceding year was caused by the abandonment of certain highway lines which it would otherwise have been necessary to reconstruct at a large cost and the transfer of the wires therefrom to new poles or poles on parallel railroad routes.

The decrease in taxes was due to the settlement in the preceding year of disputed accounts with several states. The cost of construction of new property for the year was $1,117,651.

James Stillman was elected a director to take the place of R. G. Rolston, deceased.

The annual statement is as follows:

	1898.	1897.
Net revenues	$23 915,737	$22,638,859
Expenses	17,825 582	16 906,656
Net earnings	6 090.151	5,732,203
Interest and sinking fund	906 546	935,501
Balance	5,183,605	4,796,702
Dividends	4,867,911	4,792 855
Surplus	315,694	3,847
Previous surplus	7,647 541	7 643,694
Total surplus	7 963,235	7,647,541

The expenses of the year compare as follows:

Operating and general	$12,749,273	$12 004.161
Rentals, leased lines	1,870 006	1,573,497
Maintenance and reconstruction	2,688,283	1,315,370
Taxes	866,225	690 245
Equipment offices and wires	251,795	203,423
Totals	$17,825,582	$16,906,656

To What Extent Should Street Railways Engage in the Amusement Business?

PART II

Mr. Lang, Toledo: I want to offer a few suggestions that may be of value. Our city has 140,000 inhabitants. We are conducting a place of amusement on the lake shore, about 5½ miles from the center of the city. It was not established by our company, but is now controlled by us because we have purchased the road that built it. I had some misgivings about the value of the enterprise when it was started. We rectified some of the mistakes, and one of them was that they started it on too large a scale and did not charge any admission. At the outset a person who paid the street-railway company 10 cents could go to the grounds and obtain free admission and obtain a free seat in the casino building, where vaudeville and like entertainments were given from two to four in the afternoon and again from eight to 10 in the evening. The ride on the cars included a seat in any part of the house. At the same time they sold all sorts of soft drinks, and had other amusements on the grounds. When it came into our posession we found it was losing money. It was said to have cost in the neighborhood of $65,000 in land and buildings, and finding that it was running behind, we imposed an admission fee of five cents, which makes it correspond to what the gentleman from Boston says, 15 cents for the round trip and admission to the grounds, and the patrons were registered by turnstile, so that we know at all times how many persons go in. In addition to that, instead of giving free seats in the main park or body of the house, we put in reserve seats, for which we make a charge of 10 cents. We found that was working so well that we went into the gallery and put in reserved seats in the first two rows. The people of our city and friends of ours said we were making a great mistake in imposing this admission fee of five cents and charging for reserve seats, but we tried it and it has been eminently successful. We have boxes that will seat four persons which sell for 25 cents. We found last year that we came out a few hundred dollars ahead of the operating expenses, but we run the casino company as an entirely independent company, without any relation to the railroad company at all. It increased the earnings of the railroad company about $40,000 last year. This year the casino company will net about $6,000 after making provision for fair depreciation upon the buildings, and the railroad company will increase its earnings over $50,000. Now, I realize that conditions differ in different places. What would be a desirable thing in Boston or New York might not find favor in another place of smaller population, and vice versa. But if any of you are further interested in this subject, I will be glad to give you any additional information I can.

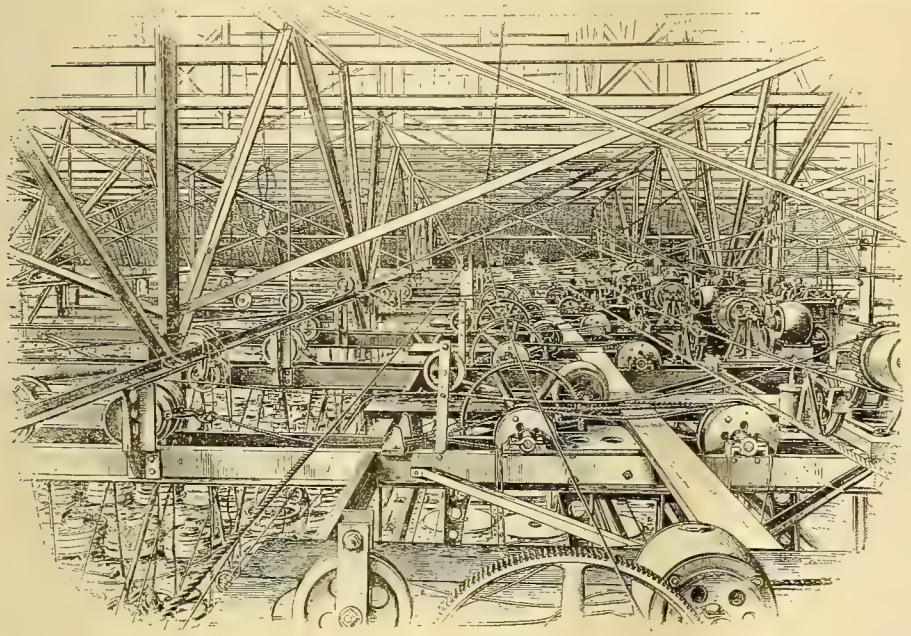


FIG 4. ELECTRICALLY OPERATED FOUNDRY.—OVERHEAD ARRANGEMENT OF MOTORS

Mr. Davis, Williamsport: The practice has been in Boston and in the New England states for the railroads operating parks to furnish amusements and rely upon their car fares alone to reimburse them for their working outlays. I would like to have the experience of the managers of these parks as to whether they think it is profitable, and how long such parks have been operated at a profit.

Mr. Wyman, New Orleans: I am not from the New England states, but we have the advantage of a long season, from the middle of April to September, and usually a supplementary season during the month of September. We charge nothing for admission to our grounds. We have a resort on Lake Pontchartrain, about six miles from the city. We have a round-trip car fare of 15 cents. The grounds are very extensive, large hotels on either side which we own, and a large platform, a pier, bathing houses, boat houses, and, of course, anyone who uses the bathing houses or the boats has to pay extra, but the general thing is free. We provide a very fine band, our weekly payroll for amusements running from $2,000 to $2,200. The park has been operated on that scale for the last two or three years. We did not begin in such an expensive manner. We went at it in a small way, but, finding it profitable, we have increased every year; we have chutes and merry-go-rounds, and all sorts of things of that kind. We keep an accurate record of our operating expenses and our receipts, keeping that road entirely separate from other roads and keeping an accurate record of all the expenses at the beach. We find that our proportion of receipts to expenses varies little from the ordinary electric road. In winter we do not do so well. Our operating expenses run from 70 to 80 per cent. of the gross receipts, and that includes the winter time, when the people do not go out, but we run the road all winter. Of course we have some rentals there, and we find we are amply repaid by the travel. We charge nothing for entrance to the park to anyone who may come in a carriage—it is at the end of the Shell road—we allow everyone free access, and it is our impression that the fact that it is there helps us. We carry a man 12 miles for 15 cents and give him a good show, good music and other things as good as he can get anywhere else for half-a-dollar, and the people are inclined to come.

Mr. Holmes, Kansas City: I notice a gentleman in the audience who was with our road in Kansas City for four years and laid out the first park for our company. He has had a great deal of experience with parks since that time, and we ought to hear from him. I refer to Mr. Chapman.

Mr. Chapman, Chicago: I am somewhat rusty now on the amusement business, but I will relate a little experience at Grand Rapids, Mich., where the lines were converted from cable and horse cars to electric, and a very pretty park was constructed at the lake, where the average haul was four miles from the center of the city. We commenced, as nearly everybody else has done, in a small way. The first attractions were merry-go-rounds and things of that kind. It gradually became more and more expensive, better music, and, unfortunately, more and more bicycles, so that while the patronage largely increased, the expenses increased in much greater proportion. Since I severed my connection with the Grand Rapids property they have found it advisable to build a small auditorium, and they help out their roads by charging admission to the reserved-seat section of this auditorium, allowing the people to stand on the outside without extra charge. They furnish attractions costing them from $400 to $600 a week, and are making the amusement feature more successful than it ever was before since the days of the introduction of the bicycle. Before that time it was very satisfactory.

Mr. Thompson, Muskegon: We have a park at Muskegon, and also pavilions and theatrical attractions. The last three years we have conducted the attraction part of it on a little bit of a stage, attached to the main building, and have found it fairly profitable. This year we went to an expense of $2,000 and built a properly constructed addition for theatrical entertainments with 584 reserved seats and the stage lighted by electricity. Up to this year we allowed everybody in the park without any restrictions. This year we allowed no one in the pavilion unless they purchased tickets on the cars. They may go into the old part of the building, which has flat bench seats, with a capacity of 700, for the fare. The reserved seats cost five cents extra, and this year we have more than paid the cost of the theater from the reserved seats. The increased travel in the months when the weather was fine was $1,000. A good park with good attractions, in my opinion, will be a paying venture for a street-railway company.

Mr. Cahoon, Elmira: One point does not seem to have been touched upon by any of the speakers, and that is the increased liability to accidents. If we increase the travel by means of amusements or parks or entertainments, in carrying the greater number of people we certainly increase very materially the chances for accident, and it would seem to me that in the matter of expenses the question whether these parks pay or do not pay, the matter of damage suits and of the liability for damages that are incurred should be considered. I think that would open up a profitable field for discussion. This amusement question is becoming a very vital one, especially to the smaller roads. The road which I represent is of that class. We have a city of about 45,000 inhabitants, and at the end of our line is a public park. We cannot control any of the privileges, but we can pay all the expenses for having amusements there, and unless we do that we do not get any travel there to speak of. The question of damages has come up on two occasions, and I think largely on account of the greater number of passengers carried incident to the amusement. I should like to hear something of the experience of others, and whether they reckon there is a profit in the amusement business, taking this question of damages into consideration.

Mr. Jones, Memphis: It seems to me the whole question is one of locality and conditions. Take the case cited by Mr. Wyman. He has a resort which was there before the electric road was put in. I have often paid $5 for a carriage to drive out there. It is a beautiful place. The more advantages he gives the people the better his patronage. Take a park in Boston. I do not see how a park could be profitable here, because the season is short, unless you have a park which people will visit in the afternoon. If you expected people to go to a park in the afternoon at New Orleans and Memphis, it would be an absolute failure, because they do not go out at all except in the evening. We think we can do more in that line by having a park, for the reason that our season lasts about eight months. Our people go out in the evening early in April and I have seen the temperature on Christmas eve 78 degrees with us.

Mr. Heft, Meriden: We are operating a park that we inherited when we bought the road. The people had spent about $45,000 on the park. They had put up posts to tie their horses to, put launches and boats on the lake, that everyone might take a ride, and built a casino and a switch-back road. They provided a baseball grounds, and all of these things were free to every man who chose to enter. I want to say to you when the balance sheet was figured up at the end of the year we found that our experience has been about the same as the gentlemen from Milwaukee, and I think the street-railway men of to-day have run mad on this question of amusements, providing everything without any recompense whatever, and if we are going to make these parks pay, they must be run upon a business basis, the same as Mr. Claflin, who charges an admission fee. We must not forget that when we add to the receipts we add to the operating expenses of the road, and all these things must be figured out, or at the end of the year we shall be short. I am very glad to hear from the gentlemen on this question; and it seems that the only man who makes any money, with the exception of Mr. Wyman, who lives in the sunny South, where everything comes free, is the man who charges an admission to his park.

Patents Not Taxable.

The Court of Appeals of New York, in the tax case of the Edison Electric Illuminating company of Brooklyn, has sustained the Special Term and the Appellate Division of the Supreme Court in that borough in their decision that the state has no power to tax a patent for an invention granted by the United States. The language used by Chief Justice Marshall in the celebrated United States Bank case has been quoted in almost every discussion of the question, and is set forth in the opinion of Chief Judge Parker in the Edison case. "If the states may tax one instrument employed by the government in the execution of its powers," he wrote, "they may tax any and every other instrument. They may tax the mail; they may tax the mint; they may tax patent rights; they may tax the papers of the custom house; they may tax judicial process; they may tax all the means employed by the government to an excess which would defeat all the ends of government." Here was a declaration by the clearest implication that patent rights were not taxable by the states; and since it was made it has been regarded as settling the law on the subject, wherever the taxability of patents has been litigated. The highest courts of Pennsylvania, Kentucky and Tennessee have held that the tax laws of their respective states have no application to patents, but the question has not until now been passed upon by the New York court of last resort.

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Attention is directed to the significant increase in the foreign trade of the United States for the last few months in electrical machinery, supplies, fittings and kindred lines. At the present time South American markets are proving inviting for manufacturers of electrical goods, and orders for electrical machinery and equipment continue to arrive from Argentine Republic. Recent advices from Buenos Ayres say that new electric-light companies are being formed throughout the republic, backed by French and German capital. These electrical enterprises are beneficial to American manufacturers, however, for in a majority of cases the specifications call for American machinery and equipment. The electric roads in Argentina are also being equipped with material from the United States. Competent traveling salesmen, familiar with Spanish and Portuguese, are the most important factors in extending American trade with South America.

An address prepared by the federal commission recently appointed by the president to revise and amend the laws pertaining to patents and trademarks is presented on another page. It deals particularly with the legal aspect of the question, but it possesses sufficient interest for inventors and manufacturers to warrant its presentation here. No class of inventors is more interested in securing an adjustment of patent and trademark laws than those engaged upon electrical problems, and there is no class of manufacturers with greater interests in protecting American products abroad than those of the electrical and allied industries. The subject should receive the careful attention of every worker in this field, and those who are in position to do so should actively co-operate with the commission in the revision of the present patent laws, so as to secure uniformity in the practice of all nations.

Touching upon the work of defense of American coasts, the testimony before the War Investigating Commission by Gen. John M. Wilson chief of engineers, is very interesting, as well as creditable to the corps which he commands. When the war with Spain broke out, the mining defenses of the harbors were not complete, and in his orders General Wilson said; "Use every effort in this emergency; lay your cables and junction boxes; get your mines ready; purchase what is absolutely necessary for the mines that you cannot procure at once from Major Knight; extemporize temporary mines; employ all the help you want; but go ahead and show what the corps of engineers can do in an emergency for which our country is unprepared." General Wilson reports that during the war period 400 miles of cable and 150 tons of high explosives were bought, with 1,650 torpedo cases, many searchlights, and so on. No fewer than 535 mines were planted in 28 different harbors, and the expenditures on them for the war period reached $1,661,000. The engineers certainly made a creditable showing, and in no branch of the service was more glory reflected than in the electrical department.

Electrical supply dealers should not ignore nor belittle the increasing business of the great department stores of Chicago and other cities in electrical supplies. Several of these stores have regular electrical-goods departments whose bargains are advertised in the daily papers alongside of those in dress goods, parlor furniture and tinware. These stores make low prices, are centrally located and deliver the smallest article, free of cost, anywhere in the city or its suburbs. Their electrical business at present is confined mainly, but not entirely, to house goods; but it is possible that in time they may advertise a "mark-down sale" in dynamos or voltmeters.

The secret of their success lies principally in the attractive prices they offer to the consumer and the wide publicity they give to their "bargains" by advertising. Their example in both respects is not to be despised by the regular dealers in electrical supplies: price counts and intelligent advertising is always valuable.

Of course, in many ways, such as the buying of large bankrupt stocks to be sold at retail at a slight advance, in the employment of cheap labor and in the reduction of selling expense due to the magnitude and variety of the business carried on under one roof, the ordinary supply house cannot hope to compete with the big department store. Probably it doesn't want to do so on those conditions. It is to be supposed that the principal manufacturers will always prefer to sell to the regular dealers, so that the best specialties and the leading lines of wires, lamps, switches, instruments, etc.—the cream of the business—will remain in the hands of the simon-pure supply dealers. But it is not always safe to prophesy, and the supply men should keep a sharp eye on the department stores—their prices and methods. They may depend upon it that the small consumer does so right along, and his business should be worth having.

The relative degrees of responsibility for the condition of public highways and other public places occupied in part by quasi-public corporations holding franchises or enjoying special privileges have long been a source of legal controversy and a subject of many conflicting opinions and decisions by legal authorities. An interesting case in which the city of Denver was involved has just been passed upon by the United States Circuit Court of Appeals. That tribunal maintains that any corporation, municipal or otherwise, or any person who may be the owner of an electric-light and power plant, is under obligation to use ordinary care in its maintenance and operation, in order to prevent injury to the public; but the court insists that simply because a municipal corporation permits another to erect and operate such a plant in the city streets, it does not necessarily become charged with the duty of maintaining the poles, wires and lamps connected therewith in a safe condition.

The general proposition had been advanced that the city was bound to inspect, from time to time, all poles, wires and lamps that might have been lawfully placed in the streets, and to repair any defects that might be disclosed, in order to prevent them becoming an obstruction to the safe use of the streets, but the court did not assent to it. On the contrary, it favored the contention that the rights of the public were sufficiently protected by imposing the duty of keeping watch over these appliances upon the corporation or person owning and operating them, and holding the city liable only in cases wherein, after actual or constructive notice of the existence of danger to the public in the use of the street, it did not use diligence in obviating the danger thus created.

A dissenting opinion was filed by Circuit Judge Thayer, who maintained that if a city authorized a telegraph, telephone or electric-light company to erect a tall wooden pole, burdened with wires, on one of its thoroughfares, it was affected with knowledge, from the very nature of the structure, that, in course of time, it would decay and become dangerous to those who have occasion to use its streets, and that, therefore, a municipality which authorized such poles to be erected on its streets was under an obligation to the public to see that they were examined in a proper manner and at reasonable intervals, either by its own agents or by the persons or corporations whom it had authorized to erect them, and that the duty of inspection did not rest exclusively upon the latter.

In the consideration of this subject it was further held that in all cases where telegraph, telephone, electric-light and power and electric-car companies obtain and exercise the privilege of erecting and maintaining poles, wires, lamps and other appliances in the public streets they are bound to know that the operation of their plants may create dangers to persons exercising the primary and paramount right of passage along or across the highway. The companies are not insurers of the safety of the public against all dangers arising from the lawful placing in the street of the appliances pertaining to the business carried on by the companies, but they are bound to know the dangers which may naturally be caused by such use of the streets, and to guard against them by the exercise of all the foresight and caution which can be reasonably expected of prudent men under such circumstances, although the court expressly states that this does not impose upon a company the duty to make such an examination of its appliances as would certainly secure a discovery of all hidden defects therein. The point is made, however, that knowledge acquired by a lamp trimmer of the defective condition of an electric-light pole, when he was going his rounds as an employe of the company, would be imputable to the company where it was proven beyond dispute that it was his duty to take notice of defects, and report them, though, as a matter of fact, he may not have made any report, or not to the proper person. The court entered into the details of the case more fully than is customary under ordinary conditions to define clearly the limit of responsibility of the city, the operating company and the public.

Work of the Patent Commission.

The federal commission which met in Chicago on October 6th and listened to arguments upon the subject of revising the laws pertaining to patents, trademarks and commercial names, has prepared the following address:

To Citizens of the United States Interested in Inventions and Trademarks as Related to Foreign Commerce.

The commission appointed by the president with the advice and consent of the Senate (Act No. 121, approved June 4, 1898) "to revise and amend the laws of the United States concerning patents, trade and other marks, and trade or commercial names, * * * * so far as the same relate to matters contained in or affected by the Convention for the Protection of Industrial Property concluded at Paris, March 20, 1883, the agreements under said convention concluded at Madrid, April 14, 1891, and the protocols adopted by the conference held under such convention at Brussels, 1897, and the treaties of the United States and the laws of other nations relating to patents, trade and other marks, and trade or commercial names," respectfully requests all citizens of the United States interested in inventions and trademarks as related to foreign commerce to give expression to their views on the general subject before the commission. In order that replies may be more easily grouped according to subjects, the commissioners respectfully call attention to the following matters as some of those which may be discussed:

The convention requires in general terms (Art. 2) that the citizens of one state of the Union [which comprises the nations included in the agreement] shall enjoy in another all the rights which the citizens of the latter state enjoy in regard to patents for inventions.

1. What advantages do the laws of the United States accord to citizens which the citizens of the other states of the Union do not "enjoy"?

A. Section 4902 of the Revised Statutes grants the right to file caveats to citizens of the United States only.

Is this a right which citizens of other states of the Union are entitled to enjoy under the convention?

The second clause of article 2, in explanation of what is to be enjoyed, says:

"In consequence they shall have the same protection as the latter (citizens of tthe United S ates) and the same legal recourse against all infringements of their rights."

Would the filing of caveats by citizens of other members of the Union be disadvantageous to our citizens?

Does the reason for the caveat still exist?

May the caveat be abolished without injury?

B. In interference proceedings before the Patent Office the foreign applicant is allowed to carry back the date of his invention to the date of his foreign patent or of his disclosure in this country, and not to the date of his application abroad.

Should this rule be changed by statute?

What is the effect of the second clause of article 2 of the convention noted above on the answer to this question?

C. Section 4896 of the Revised Statutes devolves the right of applying for and obtaining the patent for an invention of a deceased person on his executor or administrator in trust, etc. It has been held by the Patent Office that this applies only to an executor or administrator authorized to act by some court of competent jurisdiction located in the United States.

Under the law requiring an application in the United States within seven months after the application abroad, this ruling of the commissioner of patents becomes of importance, and suggestions are desired.

2. Trademarks.—It is to be observed that while the members of the Union do not agree to grant any specific protection to inventions, but only to establish a special service of industrial property (Art. 12), each member does agree "that every trade or commercial mark regularly deposited in the country of origin shall be admitted to deposit and so protected in all other countries of the Union" (Art. 6). The only exception is contained in the last clause of the same article, viz., 'That deposit may be refused, if the object for which it is asked is considered contrary to morals and to public order."

The obligation to register is made more specific in the protocol adopted with the convention (Pro. 4).

There is the further obligation of seizure of objects bearing counterfeit marks. (Art. 9).

The Conference of Brussels proposed to modify this article by adding a clause permitting the prohibition of importation in place of seizure.

Is a national law, which shall be enforceable, irrespective of the state laws of the several states of the United States, required by the convention?

Would such a law be a law to carry out a treaty and therefore constitutional?

Could such a law include trademarks of citizens of the United States used in foreign commerce?

Must such law, if granted, allow of the registration of every foreign mark duly registered abroad (subject to the rules of priority), except such as are "contrary to morals and to public order?"

Should the tariff act of 1897 (30 Stat. at Large, p. 207, sec. 11) be so amended as to allow citizens of other states of the Union for the Protection of Industrial Property the same privilege of filing their marks with the secretary of the treasury and of the exclusion of goods bearing similar marks from the United States, because of article 2 of the convention?

3. Agreements or arrangements between some of the members of the Union. These are: 1, to prevent false ndications of origin, and, 2, to provide for international registration of trademarks.

We have not adhered to these agreements and therefore are under no treaty obligations in respect thereto.

A. We have no statutes to prevent the use of false indications of origin, such, for example, as the use of the words "Port," "Madeira," "Burgundy," for wines not grown in those regions.

Is such a statute desirable?

Is it desirable that we should adhere to this agreement?

We export large quantities of butter, for which we get no credit abroad, because it is sold as Danish butter. Would it not be for our advantage to join in an agreement which would stop this and like false indications of origin?

Is this agreement in a satisfactory form?

B. International registration of trademarks is now in force under the agreement of Madrid between Belgium, France, Brazil, Italy, The Netherlands, Portugal, Spain, Switzerland and Tunis. Austro-Hungary has adhered subject to ratification by its legislative body.

The expense over and above the charges of our own government will be only 100 francs for all these countries for each mark.

In case our government adheres to the agreement, is anything more required than a law fixing the procedure under which citizens of the United States may take advantage of it?

Is the agreement in a satisfactory form?

4. The act under which the commisisoners were appointed says: "That they shall report to Congress as soon as possible." "That the report shall be * * * * accompanied by references to such treaties and foreign laws relating to patents, trade and other marks, and trade or commercial names, as, in the opinion of the commissioners, may affect citizens of the United States."

The commissioners therefore request the expression of the views of our citizens on the subject of foreign patent and trademark laws affecting them.

Foreign nations may be conveniently divided into three classes: 1. Members of the Union for the Protection of Industrial Property; 2, non-members who have patent laws, and, 3, nations which have no patent laws.

1a. The nations of the first class can be subdivided again into:

a. Those who do not grant patents for chemical combinations.

b. Those who do not grant patents for pharmaceutical preparations.

c. Those who do not grant patents for processes.

d. Those who require the working of an invention within a short period of time after the grant of a patent therefor under penalty of the lapsing of the patent.

e. Those who require periodical taxes to be paid under penalty of the lapsing of the patent.

f. Those who require patents for the same invention in other countries to be kept alive under penalty of the lapsing of the patent granted by any one of them.

g. Those who require the absolute secrecy of the invention before application for a patent, modified, however, by article 4 of the convention.

At present the United States makes but one condition to the grant of a patent for "any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement thereof," for the period of 17 years, unlimited by any requirements of the payment of taxes, of working or keeping alive a foreign patent for the same invention. That condition is that the patent shall not issue, if a foreign patent for the same invention shall have been applied for more than seven months prior to the application in the United States.

This condition is applicable to all persons, whether citizens of the United States or not, and, therefore, does not violate the convention which entitles citizens of other members of the Union to have the same protection as our own citizens "and the same legal recourse against all infringements of their rights under reserve of complying with the formalities and conditions imposed upon subjects or citizens by the domestic legislation" of the United States (Art. 2 of Convention).

Should the patent laws of the United States be so amended as to place other conditions upon the grant of patents to citizens of other states of the Union than that above recited?

Should a provision be inserted in the law forbidding the grant of a patent in the United States, in the case of the prior application for and grant of a foreign patent for any other invention than that for which said foreign patent was granted?

Should a citizen of the United States or a German subject apply for a patent in Germany for a process of making chocolate, as the German government only grants patents for processes and not for articles made by such processes, be granted a patent in the United States for both the process and the chocolate when made? (Germany is not a member of the Union, but is taken as probably the most familiar illustration).

Should there be inserted in the grant of a patent for an invention for which a patent had previously been applied for in another country—by the laws of which a patent lapses for non-working, non-payment of taxes or the lapsing of another patent in another country—the same conditions as to the lapsing of the United States patent?

3a. As to those countries which are not members of the convention, we are under no treaty obligations.

Would it be wise to make grants of patents to citizens of those countries on lines of strict reciprocity?

3a. As to those countries which have no patent laws we are under no obligations to grant patents to their citizens for their inventions.

4. Shall we refuse to grant patents for inventions to citizens of countries which do not grant patents to our citizens?

5. We have not attempted in the above series of questions to exhaust the whole subject, but rather to stimulate discussion.

Replies are earnestly requested. They may be sent to any member of the commission. The work will be expedited if they are sent in triplicate.

The commission desires to make its report to Congress at the opening of the session in December next.

Dated Chicago, October 8, 1898.

(Signed) FRANCIS FORBES,
P. S. GROSSCUP,
A. P. GREELEY,
Commissioners.

The next meetings of the commission will be held in New York on November 19th and 21st, and in Washington on November 22d.

Copies of the convention and agreements may be obtained of Francis Forbes, 34 Nassau street, New York.

Electrical Development in the Island Possessions of the United States.

In Cuba telegraphic communication exists between the different interior towns and principal villages over lines that were erected by the Spanish government, in the rudest fashion, many of the wires resting on trees without the vestige of an insulator. The only communication between Santiago de Cuba and Havana is over an English cable between Santiago and Cienfuegos, and thence to Batabano over the Cuba Submarine Telegraph company's line, from which place messages are transmitted to or from Havana by land. There are four independent cable systems operating in Cuba. The Western Union Telegraph company has four cables from Havana to Florida; the Cuba Submarine company has communication between Havana and Santiago and Cienfuegos; the West Indian and Panama company also has connection with Havana, Santiago, Jamaica, Porto Rico, the Lesser Antilles and the Isthmus of Panama; the Compagnie Francaise de Cables Sous-Marins connects Havana through Santiago de Cuba with Haiti, San Domingo, Venezuela and Brazil. The Statesmen's Year Book for 1898 is authority for the information that there are 2,300 miles of telegraph line, with 153 offices, in Cuba. The principal towns in Cuba are lighted by electricity, as are also the greater number of the sugar estates.

There are about 475 miles of telegraph lines in operation in Porto Rico, and submarine cables connect San Juan with St. Thomas and Jamaica. A British report makes the statement that the telephone systems of San Juan, Ponce and Mayaguez have recently been contracted for by local syndicates. A United States company has obtained the contract for the supplying of material. One hundred stations are already connected, and it is expected that 200 more will soon be in operation. Submarine telegraph cables may be imported into Porto Rico free of duty. Motors of all kinds are subject to a duty of $2.31 per 100 kilograms.

The capital of Hawaii, Honolulu, is a city numbering 30,000 inhabitants, and is lighted with electric light; it has a complete telephone system. The islands of Oahu, Kauai and Hawaii have telephones to every accessible point. The rent of an instrument is moderate, and a small charge for service is made for those who do not or cannot afford to possess an instrument of their own. On the Island of Maui the telephone system is as yet incomplete.

The city of Manila in the Philippine Islands is lighted by electricity and has a telephone system. There are about 720 miles of telegraph in these islands. A cable connects Manila with Hongkong; one runs from Manila to the Visayas Islands, and one is laid to Cape Bolinao. As in Porto Rico, submarine telegraph cables are admitted free of duty, while motors are subject to a duty of 51 cents per 100 kilograms.

Liability for Death Caused by Electric Shock.

The Supreme Court of Canada, the final court of appeal in the Dominion, now in session in Ottawa, rendered judgment in the case of the Citizens' Light and Power company of Montreal, appellant, and Lepitre, respondent. This is an action for damages resulting from the death of an employe of this electric company, which was caused by an electric shock. It appears that while engaged in placing wires for the company, Lepitre, by accident, touched a wire which was alive, and death resulted. The Supreme Court dismissed the appeal and held that the company was guilty of negligence in not causing the wires to be covered, and that the company was clearly liable for damages resulting from the death of its employe.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The town of Swan, Ia., will vote on granting a franchise for a telephone toll line to Knoxville for the Knoxville Electric company.

The Western Electric Telephone company has begun work constructing a telephone line from Albert Lea, Minn., to Twin Lakes and also to Geneva.

The telephone exchange at New Richmond, Wis., is growing rapidly. It has free toll connection with several towns in the county. There are nearly 100 instruments in use.

The Wisconsin Valley Telephone company's line has been completed to Ironwood, from Ashland, Wis.

The Mississippi Valley Telephone company's exchange at Muscatine, Ia., is about completed.

Rolfe, Ia., has telephone connection with Bradgate and connects there with Gilmore City and other points.

The city of Waterloo, Ia., has ordered the Cedar Valley Telephone company to remove its telephones from all city buildings. The city alleges that when the franchise was granted the company promised free telephones for the city, and has failed to keep its promise. The company denies that there was any such agreement and says that it has furnished two instruments free ever since it has been in business, without any agreement.

A local company is arranging to put in a telephone exchange at Wymore, Neb.

C. O'Brien Reddin has bought a controlling interest in the Spokane and British Columbia Telephone and Telegraph company, and has changed the principal place of business from Meyer Falls to Spokane, Wash. The company has over 200 miles of wire, running from Spokane to Rossland, B. C. Material improvements are to be made in the system.

W. B. Aris, late of the Spokane and British Columbia Telephone company, at Spokane, Wash., will build a telephone line from Kettle Falls, Wash., to Davenport.

Heavy rains, accompanied by severe wind, damaged the telephone system at Pipestone, Minn., recently.

The Adel, Ia., telephone exchange starts in operation with 50 instruments in use.

The Standard Telephone and Electric company, a southern Minnesota company, is building a toll line to La Crosse, Wis., from Brownsville. The company has about 60 stations in Minnesota and Iowa. It will connect in La Crosse with the La Crosse Telephone company.

The Northwestern Telephone Exchange company has completed its absorption of independent telephone companies begun several weeks ago, by taking in the Western Electric Telephone company, operating in northern Iowa and southern Minnesota, using 150 miles of wire in Minnesota and 850 in Iowa. The Iowa system has been absorbed by the Iowa Telephone company. Charles J. Glidden of Lowell, Mass., president of the Northwestern Telephone Exchange company, was in Minneapolis lately closing up the deal.

The Wolf River Telephone company will extend its wires from Clintonville, Wis., as far north as Marion this fall, and on to Antigo in the spring. The company now has in operation over 100 miles of wire, and pays good dividends.

A toll line is being constructed between Madison, S. D., and Woonsocket, S. D., for the Southern Minnesota Telephone company.

Express Service in New York.

[From the New York World.]

The silvery voice of the telephone girl is to go. She will no longer be permitted to chat with the subscriber's office boy or to "sass" the subscriber. No longer will she ask if you are through and then add, "Why didn't you say so?" You will not even be permitted to hear the gentle voice call across the wires to a friend:

"Mamie, are you going to wear that pink waist to-morrow night at the Lady Telephone Operators' ball?"

The inventor has done it all. He has conceived a new switchboard for telephone exchanges which makes an automaton of the telephone girl. Thus the halo of romance about the girl is wafted away by a system of wires and spokes and lights, and the farce-comedy author of the future will have to return to his old stock-in-trade—the hotel clerk, the "Rube" in town or the young widow and the gay husband.

Managers of telephone companies have been made prematurely old by complaints against "sassy" operators. Big rewards have been offered to the man who could prevent these disagreements between subscriber and operator, and at last that man has come. The results of his work will be apparent a week from to-day, when the new and wonderful switchboard will be placed in operation at Harlem.

It is known as the common battery system. Instead of ringing and "helloing" until your tongue is paralyzed, you will lift your telephone from the hook. Instantly a small electric lamp opposite your number on the switchboard will be lighted and will remain lighted until "central" asks your number. You answer and "central" says all right. That is the limit of your conversation with the once sociable "central."

When the connection is made this light goes out and another light appears. Under the new system "central" will know that you are busy as long as the second light remains lighted. When you are actually through you place your telephone on the hook, which cuts off the second light. Another light appears to tell "central" that the conversation is ended and you are disconnected.

Finally there is a larger lamp over each operator's head which is kept lighted as long as a subscriber is calling. This is largely for the aid of the "boss," who will know whether "Mamie" and "Maggie" are talking with one another when they should be attending to business.

Extensions and Improvements.

It is proposed to establish another telephone company as a rival of the New England Telephone and Telegraph company in Worcester, Mass. It is projected by F. Plummer, and has no connection whatever with the People's Telephone company. Mr. Plummer says that a meeting will be called in the interests of his company shortly, and if business men subscribe for stock it will be incorporated.

The Sunset Telephone company has made arrangements to build a new telephone line from Brownsville to Bangor, via Rackerby's Camp, a distance of 20 miles. The contract for supplying poles has been let to L. Conrath. This line will connect with the main line running from Marysville to Quincy.

Fred. Schetter of the Empire City has returned from San Francisco. He reports that the manager of the Oregon Telephone and Telegraph company said that his company intended extending its line into Coos County.

J. I. Sabin, president and general manager of the Pacific States Telephone company, has been in Portland making arrangements for the extension of the telephone plant, including the building of six miles of underground conduit.

Coon Brothers of Rantoul, Ill., have closed a contract with B. F. Wasson, superintendent of the Farm and City Telephone company, of Farmer City, Ill., to construct and install an 80-telephone system at Rantoul. The Victor board and the Victor instruments will be used.

The Mutual Telephone company at Ashland, Ohio, has bought out the Bell company, which withdrew from the field after a long fight. There were but few paying instruments in the old system at the close of the struggle. This cut the Central Union company at Ironton out of a connection with Huntington, but it at once moved across the river and established a long-distance station at Ashland, utilizing the metallic-circuit river span already up between Coalgrove and that city.

The Union Telephone company, having purchased a controlling interest in the Southwestern Telephone company, will proceed at once to make connection between Iowa towns in that section, including Platteville, Lancaster, Fennimore, Boscobel, Richland Center, Lone Rock, Spring Green, and, in fact, all the important points in Grant, Lafayette, Richland, Sauk and Dane counties; also a line from Dubuque and Madison. Poles are now being delivered along the line and construction work will be begun at once.

Instruction for Telephone Men.

A special course of instruction for telephone men has been prepared by the Electrical Engineer Institute, and it will be given its first trial in New Jersey. A meeting of exchange managers, switchboard men, linemen and other employes of the New York and New Jersey Telephone company, from Newark, Jersey City, Paterson, Hoboken, Orange, Asbury Park, Morristown and other places in northern New Jersey was held at the office of the New York and New Jersey company in Newark recently. Alfred J. Wolf and Henry W. Livingston represented the Institute and Edward E. Winters, formerly superintendent of the New York Light, Heat and Power company, aided them at the close of the meeting in entering a large number of enrollments of students. The Institute has been so much appreciated by the officers of the company that a series of technical lectures by eminent electricians is in contemplation, to be given during the coming winter in Brooklyn, Jersey City and Newark. The enrollment of employes in the courses of the Institute, aided by these lectures, is intended to take the place of a very complete night-school system, which was, until recently, in contemplation by the officers of the company, but which has now been abandoned in favor of the more practicable plan of correspondence instruction.

Telephone Charges in Washington.

[From the Washington correspondent of the Western Electrician.]

A decision has been rendered by Comptroller Tracewell of the Treasury sustaining the act of June 30, 1898, which declares it to be unlawful to charge more than $50 per annum for the use of a telephone in the District of Columbia, any previous agreements to the contrary notwithstanding. This is the outcome of a question raised by Public Printer Palmer with the Chesapeake and Potomac Telephone company, as to the validity of a contract made for the rental of a 25-station switchboard installed in the Government Printing Office.

In his opinion the comptroller said: "In my opinion, and I so decide, from and after the taking effect of this provision of law its effect was to abrogate the contract set out, for the prices therein fixed are in excess of those fixed by the law for the use or rental of a telephone. * * * * I see no reason why the government should not share in the benefits of the provisions of this enactment, as well as the private individuals of the District. This telephone company, being a corporation, is a creature of the law, and must obey the law. It must furnish both individuals and the government the benefit of its telephone system, and do this under the rate of charges fixed by law, or give way to others who will."

The condition of the telephone business in Washington is unique. By act of Congress it is "unlawful for any person or any telephone company doing business in Washington to charge or receive more than $50 per annum for the use of a telephone on a separate wire; $40 for a telephone, there not being more than two on a wire; $30 for each telephone, there being not more than three on a wire, and $25 for each telephone, there being four or more on the same wire." The telephone company, holding that the law is unconstitutional, refused to comply with its provisions when patrons endeavored to take advantage of it, and the result has been a series of suits in which the local judges have invariably decided against the company, but the latter has determined to carry the matter to a higher court, and any injunctions issued against it are in a measure rendered void. Those using telephones are required to give surety to secure the company against loss in the event the Supreme Court shall decide the act unconstitutional, and even under the restrictions of a restraining order already issued by Justice Hagner a new subscriber would be able to procure the service of a telephone for $50, but by using its privilege of appeal, the telephone company can avoid furnishing the service unless the proposed patron pays its established rate of $125 for the use of an instrument within a distance of a mile of the central office and the graduated scale of prices adopted by the company and in force long before Congress enacted any legislation upon the subject.

Independent Telephony in Texas.

The independent telephone movement has extended to Texas, and the people of that state are taking up the subject in their usual vigorous manner. In Waco they are organizing an independent company among the business men of the town who have heretofore patronized the Bell exchange, but who are now dissatisfied with that company's methods and service. A committee of merchants has issued a circular presenting some interesting facts upon the situation. According to this statement, in towns the size of Waco the losses of the Bell companies have been much heavier than was generally realized, even by independent companies. An actual count of such cities, it is claimed, eliminating small towns and large cities, and taking into consideration only such places as average a population approximating that of Waco, develops the following facts:

"That the independent companies have more than three times the number of subscribers that the Bell companies now have; that the independent companies have considerably more than twice the number of subscribers the Bell companies had at the time the former began business; that the Bell companies have lost one-third of their subscribers since the independents began, while the latter have increased nearly threefold during the same period; that the proportion of telephones to population in the Bell exchanges is one to 116, while that of the independents is one to 38; that the rates charged by the Bell exchanges before the independent exchanges began operations were nearly double those adopted by the latter; that the present rates of the Bell companies are but little more than one-fifth of their former rates, and considerably less than one half those charged by the independents; that the Bell companies have almost universally, for the time being adopted the policy of giving absolute 'free service' rather than remove their telephones when so ordered; that the independent companies have, with two isolated exceptions, maintained impartially the rate adopted in the beginning; that two-thirds of the independent exchanges have constructed extensive long-distance connections, while their average age is less than 18 months; that the Bell companies have

almost invariably fought opposition with both nominal rates and absolute 'free service,' and thereby obtained all the undesirable patrons in the town and lost the desirable portion; that everywhere the people, as a whole, have stood loyally by the home companies and thereby made them 'independent' of the actions of the Bell monopoly."

This examination has convinced the committee that a bona fide and permanent decrease in rates will cause a corresponding increase in the use of telephones, as is shown by the fact that the honest reduction of about 50 per cent. made by the independent companies from the rates previously charged by the monopoly exchanges created for the independents considerably more than double the number of patrons that the Bell companies had ever before possessed. The committee has formulated the following proposition, which is now under consideration:

We want citizens to give their moral support to this enterprise and furnish material aid, by each subscribing for one share of stock in our company of the par value of $60, and for one telephone each in our exchange for a period of five years, on the following terms and conditions:

First—Each purchaser of one share of stock subscribing to our exchange to be allowed a monthly rebate, amounting to $12 per annum, from our regular rates, on telephone subscription for a period of five years.

Second—After the expiration of five years the company to have the option of taking up and retiring stock by the payment therefor of $60 in cash to the holder thereof, or if deemed to the best interest of the company, to continue the same arrangements as to rebate.

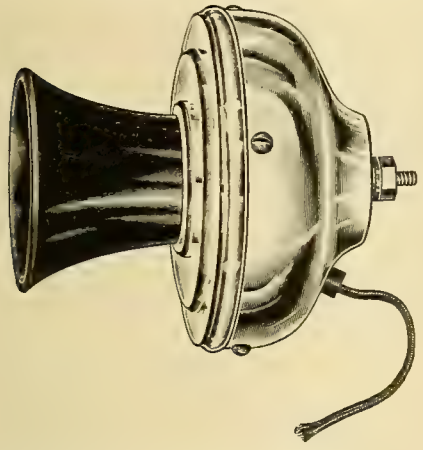
Third—The payment for each of said shares of stock to be as follows: $10 on commencement of the construction of the system, $20 on the date operation of the exchange is begun, $15 30 days after operation is begun, $15 60 days after operation is begun.

In consideration thereof we bind ourselves to build and to furnish all the balance of the money necessary to pay for a first-class, up to date, efficient, full metallic telephone exchange underground within the fire limits, with a capacity of 1,000 lines, full equipped with 500 connected telephones and to maintain and operate exchange in an efficient and practical manner for the period of five years.

No one to be permitted to buy a share of stock except he also at the same time subscribes for a telephone for each share of stock bought.

The minimum number of shares sold shall be 300, but the maximum number shall not be limited, each subscriber for a telephone being entitled, if he desires, to purchase one share of stock and thereby receive the rebate of of $12 per annum on his telephone subscription, but no one not subscribing to one share of stock now shall be permitted to purchase the stock at a later date and thereby receive the benefits of the rebate.

In the company's franchise provision is made for the free use of the service by the city and the equipment of fire stations with free telephones. An important feature in the franchise, incorporated at the request of the promoters in order to assure the citizens of their good faith, is the provision forbidding the independent company to increase its rates for service.



NEW "CHICAGO" TRANSMITTER.

The movement in Waco is attracting attention throughout the state, and it is expected that other cities will co-operate in a general movement against the Southwestern Telegraph and Telephone company, which operates the Bell exchanges in that state.

New "Chicago" Transmitter.

Telephone buyers will be interested to know that the Chicago Telephone Supply company has recently brought out a new solid-back transmitter that possesses a number of valuable features.

The "Chicago" solid-back transmitter is designed for use on party lines and toll systems where an especially sensitive transmitter is wanted that will stand hard usage. It is encased in a heavy brass shell, nickel-plated, and, to quote Manager G. A. Briggs' somewhat unique expression, "You can break it with an ax." This transmitter, too, is provided with either a metal or a carbon diaphragm, large vibrating surface and small carbon or varying-pressure surface. This transmitter, however, will only be fully appreciated after personal inspection.

The Chicago Telephone Supply company has met with considerable success in the introduction of its various telephonic apparatus throughout the United States and elsewhere, as is evidenced by the fact that a shipment was recently made as far north as Alaska. The success and increased growth of the company has recently made it necessary to secure new quarters. The company will have a ground-floor store, supplemented by a factory one story above.

Independent Telephone Company in New York.

The People's Telephone corporation, with a capital of $5,000,000, of which $2,000,000 is to be preferred stock, was incorporated with the secretary of state at Albany, October 12th. The principal office of the company will be in New York, and the company announces that it will operate lines of telephone from that city to points within the United States and Canada. The directors are S. B. Dutcher, J. E. Nichols, E. S. A. de Lima, Francis C. Travers, Frank Brainard, J. Fred Ackerman and Darwin R. James of New York city. The preferred stock will be entitled to an eight per cent. dividend, which shall be cumulative before any dividend on the common stock shall be declared, and the preferred stock is subject to redemption by the corporation five years from the date of issuance at $110 a share. This corporation may acquire stocks and bonds of other corporations and exchange its own stock and bonds for the same.

The incorporators of the company are S. Cristy Mead, Lee Kohns, Ludwig Nissen, William P. Wiley, James G. Johnson, Washington Winsor, Edward L. Molineaux, E. A. Cruikshank, B. Fischer, Milton Knapp, Charles J. Gillis, J. Fred Ackerman, Eugene H. Conklin, Martin Schrenkeiser, Jere Pangburn, Jr., George Thompson and Alfred Paradis of New York city, and Frederick Potter and E. A. McAlpin of Sing Sing. Each subscribes for $1,200 of the stock of the company.

While this new corporation expects to devote its energies mainly to telephone service, the certificate of incorporation says that a telegraph system may also be constructed and operated by the company.

A meeting of the directors of the company was held in New York on Thursday and the following-named officers were elected: Darwin R. James, president; E. S. A. de Lima, vice-president; Frank S. Gardner, secretary, and Silas B. Dutcher, treasurer. Mr. James is the president of the New York Board of Trade and Transportation, and Mr. Gardner is the secretary of the same organization. Mr. Gardner said that the idea of the new company had originated with the Board of Trade and Transportation, which, for 14 years, has been endeavoring to secure a reduction in telephone charges. The Legislature had been applied to without effect, and the Bell company had refused to make the desired reductions, so that several of the prominent members of the board had decided to organize an independent and competing telephone company.

"The new company," said Mr. Gardner, "has already begun active operations and will give its subscribers a first-class modern telephone service in about one year from date of incorporation. An immediate cut will be made in the unlimited-service rate in Manhattan from $240, the present price, to $100, the new company's charge, which includes the right of free use of its public pay stations for 100 calls per annum per subscriber. The message-service rates for business places will be cut from $90 for 600 messages to $40 for 400 messages.

"For larger numbers of messages on the message schedule the rate goes as low as four cents per message. The residence-message rate for service on private wires will be $30. To families living in apartment houses and flats an unlimited service connecting with all the other subscribers of the company will be given for $1 per month on group lines. The unlimited service for business places in Brooklyn will be cut to $75 per year, the old company's rate being $150."

Telephony Abroad.

Considerable importance is attached to the formation of the Edison-Gower-Bell Telephone Company of Europe, Limited, at London, with a capital of £75,000 in 2s. 6d. shares, of which 113,600 are preference shares. It is proposed to enter into agreements with a company of the same name and the Consolidated Telephone Construction and Manufacturing Company, Limited, to carry on the business of a telephone and telegraph company, and to construct, maintain and deal in telephones, cables, wires, lines, electric machinery, stations, exchanges and offices. The subscribers include many eminent and influential London capitalists and English families, and it is believed the new corporation will prove a strong combination. The directors are Sir Alexander Armstrong, K. C. B.; Arthur H. Baker, Charles L. W. FitzGerald and Henry Grewing.

An English contemporary reports the proceedings of a recent meeting of the Paddington vestry, at which a resolution was brough forward "that six or eight telephone stations be established at suitable points within the parish of Paddington, with lines converging to the vestry hall, for communication with chiefs of each department on parochial matters by the staff, vestrymen, or ratepayers, free of charge." It was argued that Paddington should thus lead the way with regard to the establishment of municipal telephones, and that by setting up telephone stations a great benefit would be conferred upon the parish. The matter was finally referred to the works committee to consider the costs, etc. Commenting upon this, the English journal remarks: "Surely this is a case where public-call offices could be used to advantage if the vestry already subscribed to the National Telephone company." It is evident that Englishmen of all classes are taking a keen interest in the discussion of this important subject.

Telephony in Germany has not made as much progress as elsewhere, and there are numerous complaints. At present, it is said, discontent with the single-wire telephone system in Germany is spreading. A memorial has been addressed by the Chambers of Commerce of Duisburg, Barmen, Düsseldorf, Mülheim-on-Ruhr and Solingen, in conjunction with the northwestern group of the Society of German Iron and Steel Industries and other societies to the secretary to the Postoffice, calling attention to the serious disturbances produced in the telephones by the electric-railway lines in this important industrial district. The gradual increase which is taking place in the number of telephone lines and electric railways threatens, say the petitioners, to endanger the utility of the telephone if some means are not adopted to prevent the disturbances. A contemporary remarks: "We should not have been surprised if a similar petition had been sent in before the electric railways had such a marked effect on the telephone lines. Telephony in the Rhenish-Westphalian industrial district has been always attended with difficulties owing to cross-talk, and, in spite of restrictions put on electric tramways and electric-lighting mains by the postal authorities, it will never be properly efficient until metallic circuits are adopted. Possibly the unfortunate Prussian telephone subscriber has been deterred from expressing his dissatisfaction too freely by fear of the punishment enforced in Germany for the terrible offense of beamterbeleidigung."

Litigation Over Telephone Rates.

Renewal of the fight against the Cumberland Telephone and Telegraph company in the Chancery Court at Memphis, Tenn., is announced, to enforce an equal rate of charge for telephones in the state of Tennessee and for damages growing out of alleged illegal discrimination. The rates made by the Cumberland Telephone and Telegraph company differ widely throughout the state, and the price paid for the use of a telephone for one month in one place, it is alleged, will be sufficient to pay the rent on a similar telephone in another place for a year. In comparing Columbia and Brownsville, the complainants say that there is no such difference in the situations of the citizens of Columbia and those of Brownsville as to justify a higher charge in the latter place than the former, and that while 50 cents is charged in Columbia, $1.50 is charged in Brownsville, notwithstanding the obligation imposed upon it by law to furnish all applicants without partiality or discrimination.

Municipal Telephony in Great Britain.

[From the London Electrical Review.]

The municipality of Glasgow has for some time past sought to obtain from the postmaster-general a license to undertake telephone-exchange work. Their efforts have hitherto been without avail, but, being pertinacious, and continuing their agitation, they have at length been so fortunate as to find that the policy of the political heads of the department and their own wishes coincide. As recorded in our last issue, the Duke of Norfolk has decided to grant a license, subject to parliamentary powers to act under it being obtained by the corporation, and subject also to the termination of the license in 1911. The decision is of considerable importance.

There may be reasons why the Postoffice should await the results of one experiment before granting other licenses; but, although Glasgow has a progressive local government, there are other municipalities who will certainly consider themselves as much entitled to pioneer a new undertaking, and there may even be some who feel that the success of municipal telephones is dependent on the experiment being tried in their own particular locality. Under any circumstances it will be difficult for the postmaster-general to discriminate in the granting of licenses, and it may be supposed that eventually all who ask will receive. The first impulse of many municipalities will probably be to emulate Glasgow. Others may give the matter sufficient consideration to inquire what it is that Glasgow has acquired. Unless some changes are made in the conditions, Glasgow has acquired the right (presuming Parliament permits) to incur an unknown outlay in establishing a business of which it has had no experience, on terms which shall admit of no profit, and for a period in which it is impossible to recoup expenditure. And this branch of municipal enterprise is to be built up in competition with an existing business. The acquisition of a patent was once described as obtaining a right to spend money in litigation. There was a part of the queen's dominions that was regarded as the grave of political reputations. No matter how successful a diplomatist had been elsewhere, some contretemps always awaited him in that quarter of the world. We are afraid that Glasgow has acquired the right to spend money without the possibility of adequate return, and that its reputation for municipal management may be entombed in its telephonic enterprise. We have so often touched on this subject that it is not necessary now to go into details. There is a general dissatisfaction with the telephone facilities at present afforded. If there were no other way out, the municipal competition might be welcomed; but since it is not the best solution, and, on the terms pro-

posed, is certainly disadvantageous to a municipality, we can see little good in encouraging the conflict. Still, if the ratepayers, with their eyes open, are disposed to take the risk, we can but wish them success in their efforts, and hope for some unexpected advantage in the end.

Electrical Progress in England.

[From the Electrical Review, London.]

Some few months ago English electrical circles were perturbed, perhaps even a little inclined to be angry, because a large orders for electric-railway plant had gone to America. Consolation was sought from the fact that after all we had no experience of three-phase or quasi three-phase railway work, and that our American friends were bound to secure at least some of the early contracts. A patriot may be forgiven a feeling of uneasiness when he contemplates the recently equipped tramway lines even where three-phase is not employed. Bradford, the most recent addition to English electrical lines, is mainly equipped with American plant; the important system of Middlesbrough and Stockton is American from start to finish; the new tramway at Cork will employ American plant; and, more important than all, the extensions to the Leeds tramways will be carried out with materials made in America. We have said sufficient to indicate that the competition of the United States is very real, and has to be reckoned with. Admitting, however, that we had much to learn in tramway work, and that our lesson must be based on American experience, it was not generally supposed that we could be ousted in the supplying of lighting machinery. But it is apparent that in the position where we fondly considered ourselves impregnable, we have sustained what appears at first sight to be something like a reverse. It is not surprising that our American friends should have indulged in a good deal of self-congratulation at being called upon to supply extensive lighting plant to the Metropolitan Electric Supply company, and they may be permitted to enjoy their triumph. It will be remembered that this plant was described and illustrated in our last issue. Is the matter, however, a serious one from an English point of view? It goes without saying that in consequence of this large order going to America, there has been a considerable fluttering in the dovecotes of English contractors; but a closer investigation into some of the surrounding circumstances may help to dissipate some erroneous conclusions.

The Metropolitan company has been criticized by some for going out of the country at all; others, a little more precise in their complaints, have urged that a mistake was made in adopting two-phase plant. With the first of these criticisms it is unnecessary to deal; but the second is a singularly dangerous one to offer, especially on behalf of a contractor.

It might be opportune, though diverging for a moment from the main topic, to refer to the position of the British manufacturer abroad. This country is possessed of a large and honorable corps of consuls, who, in the main, are ever ready to further British commerce; but if our memory serves us right, the one weakness urged by consuls against English manufacturers is that they are not very ready to meet the wishes of potential customers by supplying exactly what they require. The German and American manufacturer, quick to appreciate the wants of a community, will supply just what is wanted, without stopping to inquire whether it is a reasonable or a foolish demand.

We have cited this example, because it appears to us that we are drifting in a similar direction in electrical work. If a man wants to buy a continuous-current machine for a particular purpose, it is very little use criticizing his action and endeavoring to persuade him to buy an alternating-current machine. The case of the Metropolitan company is an almost parallel instance. The technical advisers of this company no doubt wanted certain plant for a specific purpose, and, having made up their minds as to their exact requirements, they went into the market to buy. It does not concern us whether they were right or wrong in their ideas; they were buyers, and simply exercised their right of obtaining what they wanted. In other words, the Metropolitan company, in the expansion of its system, required two-phase machinery, and to obtain it they had to go out of the country. It cannot be supposed for a moment that, if it had been possible to purchase English two-phase machinery, the company would have sent over the seas for it. The action of the Metropolitan company implies no inferiority to English machinery; the generators that are made in this country will compare with the best the world produces; as to engines, we need say no more than that our strength to-day as a nation is based on the steam motor.

It must not be forgotten that, though the Metropolitan company's contract is an important one, it forms but a small fraction of the electric-lighting extensions that are in progress. From all sides we hear that English works are full of orders, and it is an obvious fact, demonstrated from week to week by our electric-lighting notes, that contractors are very generally behindhand with the machinery on order. In spite, however, of the general prosperity that prevails among English electrical manufacturers, we think, in view of future developments, it would be wise for them to bear in mind the demand that is likely to arise for a different class of machinery to which we have been hitherto accustomed. If a customer makes up his mind to use two or three-phase plant, it would be better to supply it, than to endeavor to convert him to a continuous or simple alternating frame of mind. Not for a moment do we suggest that there is likely to be any immediate falling off in the demand for the special type of plant that is now being made in English workshops, but the different conditions that may arise in the development of electricity in lighting, in tramways and general power work, may bring some modification in the design of machinery. It is in anticipating those modifications that the English contractors will best meet the competition from outside. The efforts of our active American confréres are not likely to be lessened by recent successes. We must study the reasons of their success and profit by them.

[From Electricity, London.]

The backward state of some of our provincial towns is well illustrated by the recent decision of the Salisbury Bumbles to reject the electric light in favor of gas for their public-lighting arrangements. It is stubborn conservatism of this kind which is causing us to be "left" so completely in the race for commercial supremacy among the nations; and Sleepy Hollows of the Salisbury type will have much to answer for when the inevitable catastrophe comes—as it must come—unless they can be galvanized somehow into wakefulness.

[From Electricity, London.

A correspondent of the Pall Mall Gazette objects to the conduct of the experiments into electric traction upon the underground railway being confided to such notorious ignorami (if I may use such a word) as Sir J. Wooli Barry and Mr. Preece. "The first-named," he states, "is an engineer who has proved himself an able bridge-builder; the second is well known as connected with telegraphy. But it is sheer wickedness to employ either to construct a trial line for electric traction." These gentlemen can be trusted to carry out any work they undertake with credit, and, as my contemporary dryly observes, with the moral guilt of the directors it has nothing to do. It proceeds, however, to publish the following letter, which may, it considers, be allowed to speak for itself:

Sir: It is painful to contemplate the egotistical ignorance of these directors and engineers. Surely the shareholders can take proceedings against these people for ignorant waste of their money. The commonest office boy in America knows that electric motors, weight for weight, are almost double the power of steam locomotives, and even the street sweepers know that for years electric motors have been drawing trains of 40 and 50 wagons, each averaging 30 to 35 tons, up heavy gradients where steam locomotives were failures and a nuisance. Three hundred pounds would have paid the expenses to America, where more would have been learned in a month than this ignorant waste of perhaps about £19,000 will teach them in two years.

September 21st. COMMON SENSE.

Personally, I think that there is much to be said in favor of the view taken in this letter. Why are two years to be wasted (to say nothing of the £19,000) in experiments upon a problem which has been already solved in America? What we require in this country is to come abreast of the times, so as to be in a position to utilize fresh developments as they arise, not to waste two years in testing improved methods of traction, about which more advanced nations have made up their minds long since. British slowness and British caution have served us well in their time, but circumstances are fast changing, and if we cannot move more quickly, we shall have to pay very heavily for our procrastination.

Construction of an 80-mile Transmission Line.

An interesting account of the construction of the electrical power transmission line of the Southern California Power company recently appeared in Facts, a paper published in Redlands, Cal. The line is a very long one, and is now nearly completed. Redlands is 60 miles east of Los Angeles, and when the account was written it was expected that within a few days the wires would be reaching out in the direction of Los Angeles at the rate of five miles a day. At the time spoken of, with 17 men in the gang, including the foreman, the six strands of wire were being strung at the rate of a mile and a half a day, or a total of nine miles of wire a day. This was the rate of progress through the rough country east of Redlands and around the curves and upon the high poles in and near Redlands. After reaching Colton it will be practically a straight course to Los Angeles. When completed the wire will have been strung upon over 4,000 poles, about 120 feet apart, or a distance of 80 miles from the power house to the place of delivery in Los Angeles. There being six wires in the line, the total is 480 miles of wire. The wire is No. 1 bare copper wire and weighs four ounces to the foot, so the full order was for 640,000 pounds of wire. This wire cost, in this large order, over 14 cents a pound, the total cost at the factory in the East being $90,000. This is the largest single order for copper wire ever given by one firm west of the Mississippi River, and was given to two manufacturers, one half being furnished by the Washburn & Moen Manufacturing company of Worcester, Mass., and half by the J. A. Roebling's Sons company of Trenton, N. J.

The poles are 50 feet tall through Redlands and about 10 feet less for the rest of the distance. Upon each pole two arms or crossbars are placed, a short one at the top supporting two wires and a larger one about three feet below for carrying four wires. Upon these are placed insulators, specially made for the Southern California Power company, with double cups and extra large, in order that there may be as little leakage as possible. These were made by the Imperial Porcelain Works of Trenton, N. J. They cost 60 cents each and the thimbles and pins nine cents additional, making the cost per pole for insulation and attaching the wires, including the No. 6 copper wire for fastening the large wire to the insulators, nearly $4.25.

These wires are to carry 5,000 horse power, and the wire loss is expected to be, with such perfect insulation, but 10 per cent.

The process of erecting the wires is interesting. Upon each of two trucks are mounted three reels of copper wire, one to run either side of the poles and supply the three strands of wire to be supported upon either side of the poles. These reels each contain about one and a half miles of wire and weigh, gross, from 2,350 to 2,430 pounds each. The trucks, therefore, each carry 3½ tons when they start with the reels full.

The wires are strung upon the ground for a distance of 500 to 1,000 feet. Three or four men then each climb a pole with a rope and draw the wires up, one at a time in order, and lay them in position upon the arms beside the insulators. When the wires are thus placed for a distance of about a mile—less where there are sharp curves and more where the course is straight—steel cables are attached to each wire, with ropes and tackles, and each wire is firmly stretched. Five men then work the tackle, one wire at a time, "heaving away" with all their strength. The tackle is so arranged that the pulling power of 40 men is exerted with each pull by the gang of five men. While the stretching is being done men are perched upon the tops of the poles, about ten poles distant from each other, or farther in straight courses, to signal along the line for the men to "heave away" until the wire is sufficiently taut. When the wires have thus been stretched sufficiently tight the tackle is left in place while this gang of men goes on to raise another section of a mile or so and another gang follows, fastening the big wire to the insulators with No. 6 bare copper wire.

It is stated that the power company expects to have the wires all up and the machinery in place ready to deliver the "subtle fluid" in Los Angeles about November 1st.

Why the Electro-therapeutic Association Exists.

In the course of an address delivered by Dr. C. R. Dickson of Toronto, as president of the American Electro-therapeutic association, at the recent meeting of that society in Buffalo, the following passages occurred:

"The necessity for the existence of such an association as ours has been questioned not only here, but elsewhere; hence it may be necessary to explain our position. It has been asked, 'Why should there be such an association?' Electricity is only one of many therapeutic agents, and it would be absurd to have a separate association to consider each therapeutic agent. At first glance this may seem a quite rational question. Our colleges teach us how to administer opium and its various derivatives; therefore the necessity for an opium society does not exist; but do our colleges teach us anything about electricity worthy of the subject? The answer to this question is quite unnecessary in the presence of the members of our association. Anyone should be depended upon to prescribe and administer the ordinary, or even extraordinary, remedies to carry out any regulation form of treatment. But I, for one, should fear to trust myself to the tender mercies of the general practitioner of to-day, did he, in his wisdom, consider it necessary to use this agent, electricity, unless he had paid some special attention to the mastery of it. The contention is an absurdity unworthy of America, the vaunted land of progress, and of Buffalo, the electrical city. In my own benighted land, even, we are more enlightened than that. This is an age of specialism.

"The old-time practitioner, then the physician and surgeon, seems passing away. Surgery is being divided and subdivided, until at one time we feared that we were to be confronted with an appendix surgeon. Our patients are reaping the benefits of all this. Why, then, should we call a halt? No! Let onward be our cry. The time is past when a physician, the proud possessor of a solitary magneto-electrical machine, turned by a crank, considered his armamentarium electricum quite complete. One has but to glance at our programme to see to what extent electricity may be used, and used to advantage. A programme such as ours should prove a perfect revelation to him who has not kept well up to this progressive age. Could such a programme or one-hundredth part of it be intelligently discussed in any other existing society to-day not dealing distinctly with the subject? No! I greatly fear it would be a hidden book, a stumbling block.

"Electricity is an agent most powerful for weal or woe. A great responsibility rests upon our educators, and the sooner they awake from their strange lethargy, the better will it be for our reputation as an enlightened, progressive, scientific profession. The commercial world has taken such advantage

of the rapid strides of electricity as a science with fixed laws that we have laid ourselves open to the charge of neglect. Let us hasten to make amends for the past, and remove some of the reproaches that rest on this, the noblest profession in this fair world.

"Our association was organized some eight years ago, because it was felt that the subject of electrotherapeutics could not be discussed in any existing society in a scientific and practical manner without controversial digressions of no value whatever. It was felt, and felt strongly, that electricity had been left too long to the charlatan, the incompetent and the unscrupulous. It was also felt that we had another foe of hardly less dangerous character, the overzealous.

"To combat all these, and cultivate and promote knowledge of electricity wherever it can be of service in medicine and surgery, is the object of our association. It must be admitted that we are setting about this in the most practical manner possible. In fact, I know of no other association in which more practical or more useful work is being done. To carry out this idea successfully we have associated with us other than purely medical practitioners, and the association has proved a most happy one, and fruitful of nothing but good. Thus the electrical engineer and expert study electricity's laws and note its action upon inert matter. The biologist and physicist go a step farther and study these laws in their action upon living tissue, and their labors are turned to practical account by the physician and surgeon. The curative and palliative powers of the agent are thus turned to account.

"The clouds are breaking on our horizon. On my side of that imaginary boundary line we find increasing interest being manifest, and it gives me the greatest satisfaction to say that my own warmest friends in the city of my adoption are the men who stand in the front ranks of medicine and surgery, and electrotherapy has a recognized standing, inasmuch as special departments devoted to it are to be found in our public hospitals. I have had the honor to organize and now to preside over four such departments in as many hospitals; and more intelligent inquiries are being made by the students of the various medical colleges, all of whom have access to my clinics."

Organization of Coast-defense Work.

Some interesting testimony was given by General John M. Wilson, the chief engineer officer of the United States army, before the commission which is investigating the conduct of the war. It was shown that among the purchases for harbor defense were 400 miles of cable, 150 tons of high explosives, 1,650 new torpedo cases and 44 searchlights. Twenty-eight harbors were mined, 535 mines being planted. The expenditures on harbor defense for the period were $1,661,000. Intrenching tools were purchased and stored at Willetts Point sufficient for an army of 30,000 men.

A letter, written by General Wilson on April 3d, before the declaration of war, to the officers of the corps of engineers in charge of harbor defense, directed them, in view of the approaching emergency, to make the best possible torpedo defense and instructed them how to proceed. "It is not," he said, in this letter, "the fault of the corps of engineers that we are not fully prepared, but it will be its fault and that of each district officer in case we do not at once take advantage of the limited means now at our command. Use every effort in this emergency; arrange for boats; set up operating apparatus in casemates; arrange mooring anchors; lay your cables and junction boxes; prepare your compound plugs; get your mines ready; purchase what is absolutely necessary for the mines you now have that you cannot procure at once from Major Knight; extemporize temporary mines; employ all the help you want; but go ahead and show what the corps of engineers can do in an emergency for which your country is unprepared."

General Wilson inclosed a letter sent March 28th to a number of officers of the corps in charge of submarine-mine defenses asking them to organize volunteer corps for the operation of the mines. These organizations were to consist of about 120 men each, who were to be patriotic electricians, machinists and telegraph and telephone experts, giving their services free of charge. These officers were also requested at that date to find just when they could put their hands on material for equipping and working the mines.

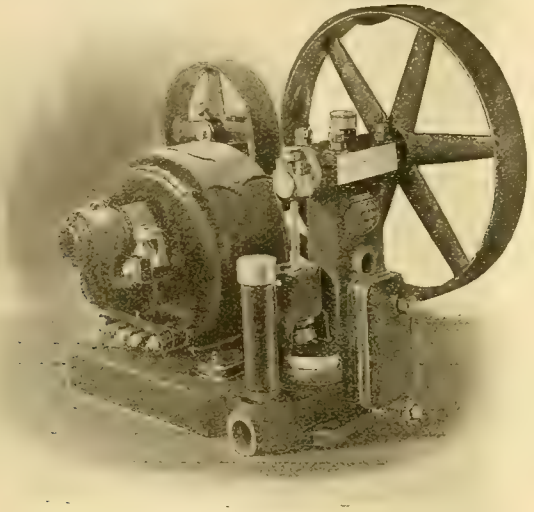
Large Motor-starting Box.

The picture shows a 500 horse power 500-volt starting box which has been in successful operation for several months. This starting box is provided with the magnetic release, and, in addition to its unusually large size, has several interesting features.

The segments are all made of hard-rolled copper and are interchangeable and easily renewed without disturbing any of the electrical connections. The starter is provided with 50 segments, thereby enabling the flow of current to be increased in quite small increments and thus practically eliminating all sparking. Notwithstanding this large number of segments, no lead wires whatever are used, the resistance being connected directly to independent segments placed underneath the copper segments.

For the sake of comparison, a one-fourth horse power starting box is shown resting on top of the 500 horse power box.

This starting box is probably the largest ever manufactured, and was built by the Cutler-Hammer Manufacturing company of Chicago, which has made the building of starting boxes a specialty for the last five years and has made an excellent reputation for itself in its chosen field.



ELECTRIC HOUSE PUMP.

Electric House Pump.

A neat and compact pumping outfit for house tank and similar service has recently been put out by Henry R. Worthington. The pump is of the type which is in use for a great variety of purposes, but is especially designed to supply the reservoir tanks of high office buildings and residences, where the pressure carried in the city mains, insufficient to elevate water above the lower stories, must be reinforced by pump pressure. The motor is connected to the pump entirely by belt, and, no cut gears intervening, the operation of the pump is noiseless.

The motor is of a type designed and manufactured by the General Electric company to meet a demand for motors adapted to the direct application of power to small machines. It is built in capacities of two horse power, one horse power, one-half horse power and one-eighth horse power. The first three sizes are wound for use on 115, 230 and 500-volt circuits, the one-eighth horse power being wound for 115 volts only. The motors are light and compact, and occupy very little floor space, while they may, by a single change in the position of the bearings, be run in any position. The magnetic circuit is laminated, not of cast-iron; the armature has toothed laminations, with coils made up and insulated before application. The motor is mounted upon the base of the pump, making the combination one of the most compact on the market. The motor is stopped and started by an automatic switch, operated by a float on the water in the tank. These pump combinations are built for capacities of 200 and 500 gallons, as required.

The Federal Court has given the Chippewa Valley Electric Railway company the right to cross the tracks of the Wisconsin Central railway near Chippewa Falls, Wis., terminating the crossing fight that has been waged for several weeks.

Equipment and Maintenance of Electric Cars.[1]

By M. S. Hopkins.

Part I.

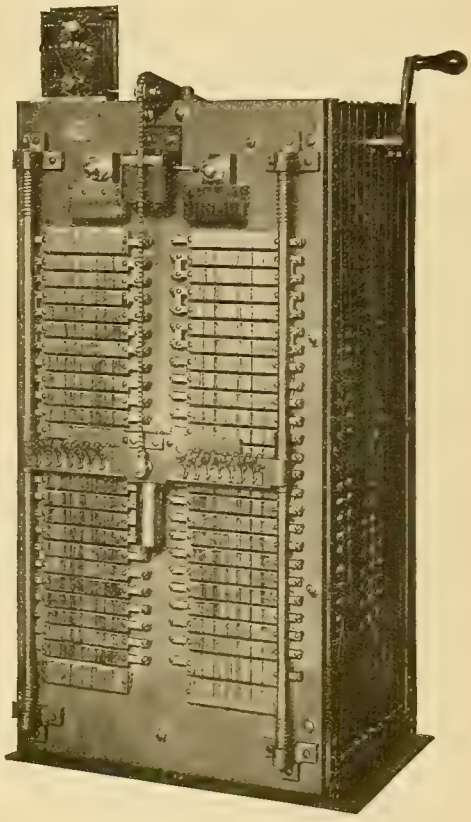
What is the best electrical equipment to purchase and how can it be made to render the best service at the least cost, is a question which daily confronts the street-railway manager and one on which he is constantly seeking advice. There can be no answer which is applicable to all street railways, and no especial merit is claimed for the views here set forth other than that they are the result of experience and born of repeated failures and successes.

Car Equipment.

No fixed rule can be laid down for the selection of equipment, as climatic conditions, character of traffic, frequency of headway, conditions of roadway, municipal regulations and grades are all elements which determine what the equipment may or should be.

Car Bodies.

For years car builders have attempted to devise a car body which would be equally durable in both summer and winter, but, judging from the character of equipment now in use on the majority of roads, such a car has not yet been produced. The combination car with movable parts is not satisfactory for winter use; it is troublesome, noisy and cold, and is lacking in many of the essential features of the open car for summer service. The open cross-seat car of the barge type with running boards on the sides seems by far the most desirable type of car for summer service, affording the largest seating capacity and the best facilities for receiving and discharging passengers, which is a great advantage in city service. Considering all features, the box car with side seats, large windows, wide end doors to the side of the center of a roomy platform and vestibules closed on one side, seems best adapted to the average conditions of winter service. While the vestibule type closed on one side is not so convenient for the handling of large crowds, yet the additional safety afforded on double-track roads should receive full consideration, even at the expense of convenience. In localities where winters are accompanied with snowfall and freezing weather, the vestibule affords protection to passengers, and motormen and conductors are able to render very much more efficient service.



LARGE MOTOR-STARTING BOX.

The long car body seems to be growing in favor with the railway manager, due to the comparatively small increase in operation, in comparison to increased carrying capacity; also it permits the increase of headway or decrease in number of cars run, resulting in a large decrease in operating expense per passenger carried.

The purchaser of car bodies should have a clear conception of the details of car construction and the specifications should clearly set forth the essential feature, while minor details of interior finish and decoration should be left to the manufacturer.

In the construction of box-car bodies, the trusses

1. Read before the American Street Railway association at Boston, September, 1898.

should be as deep as possible, and great care should be taken to secure a perfectly rigid fastening at the end of the sill, as the slightest deflection throws an undue strain on joints and framing of car body.

Where side sills are plated on the outside with steel, all season cracks should be thoroughly filled with a thick mixture of lead and oil, and the entire surface given a heavy coating of oil paint before the plate is put on. It is hardly necessary to say that all joints should be well leaded and protected from moisture. A heavy steel roof rafter in one piece should be put in at every post, and a saving in maintenance will be made by having the platform floors of oak or maple.

The trolley stand should be mounted on a trussed support, which will distribute the strain to the ends of the car as much as possible.

Ash seems to be almost universally used in posts and the light framing of cars. This is probably due to the difficulty in securing the grade of oak necessary, the lighter weight of the ash and the greater ease with which it is worked. Yet, in spite of these facts, oak is far preferable, being stronger and more elastic, and it will give a far longer life.

Trucks.

Under the average conditions, 22-foot closed car or eight reversible-seat open-car body should be the limit for a single truck. Although there are single trucks which will carry a longer body fairly well, the increase in maintenance will, in most cases, warrant the use of double trucks. The local conditions should govern the type of double truck used, the bolster type, in most cases, being preferable for long cars on high-speed suburban service, while for city service, where heavy grades and quick starts demand maximum traction, and short curves make it necessary for the wheel to turn under the sill, the bicycle type must necessarily be used. This type of truck is no longer an experiment, and while it possibly requires more careful inspection and adjustment, very efficient service can be secured from it.

Trucks should be made up of a small number of parts; cast and malleable pieces should be as light as consistent with strength. Springs should be arranged so as to prevent oscillation, and give an easy riding car under all conditions from no load to full load, and when the style of truck is of such design as to prevent the use of an under truss, the spring base must be exceptionally long and end springs so arranged as to relieve the strain on the car sills.

The brake mechanism should be so designed that the strains will be equally distributed on all parts throughout its range of movement. Pins should be of ample size to provide for wear. The slider method of support for brake beam will be found more satisfactory than the loop support. The minimum amount of friction should exist between brake staff and shoe and release springs as light as possible.

CORRESPONDENCE.

New York Notes.

New York, October 15.—Apropos of the equipment of the Third Avenue Railroad company's system for electrical operation, as mentioned in this correspondence last week, the Sun of to-day prints a Wall-street rumor that the contracts for the new equipment of that company's lines have been signed as follows: With the Westinghouse company, amounting to about $4,500,000; with the Johnson company for about 15,000 tons of 110-pound rails; with the Pennsylvania Iron company for about $3,500,000 of castings, and with the National Conduit and Cable company for the subways, amounting to about $1,500,000. However, John Beaver, treasurer of the Third Avenue Railroad company, said last night that it was not true that any electrical-equipment contract with the Westinghouse-Walker company had been made as yet, but that the other three contracts mentioned were given out a week or 10 days ago by President Elias of the railroad company. Mr. Beaver denied positively the report that the company intends to deal in electricity for electric-lighting purposes.

President Vreeland of the Metropolitan Street Railway company said early in the week that because of unexpected difficulties which have been encountered by reason principally of the obstructions caused by sewer and water pipes the Sixth and Eighth avenue lines would not be completed before December 1st. Mr. Vreeland hopes to have the Sixth avenue route open as far as Canal street by November 15th, and expects also that the Twenty-third street crosstown line will be served by electric cars in less than a month. About the approximate time when the work of laying the electric system in Broadway will be finished, Mr. Vreeland would make no prediction. The work, he said, would certainly occupy the whole of the winter, and probably the spring also.

Coroner Seaver recently held an inquest into the death of Richard Walsh of Tompkinsville, Staten Island. Walsh was killed several weeks ago while repairing telephone wires at Cebra avenue and Richmond turnpike, in Tompkinsville. The verdict was that Walsh's death was due to the negligence of the New York and Staten Island Electric company in not having its wires properly insulated, and it was recommended that the papers in the case be forwarded to the district attorney. Walsh was killed by the electric company's wires while repairing the telephone wire for a friend, who had received the order while on his way for a day's outing. The lines of the two companies ran on the same pole, and Walsh came in contact with the electric company's wire. M. S.

Northwestern Notations.

Minneapolis, October 17.—The Chippewa Valley Electric Railway company won its case against the Wisconsin Central Railway company for the right to cross the latter's tracks near Chippewa Falls, Wis., and secured an order from the United States court authorizing it to put in the crossing. It proceeded to put it in. Soon after the Wisconsin Central section crew tore out the crossing. Then the attorney for the electric company informed the foreman that he was in contempt, and, after a little investigating, the railroad company replaced the crossing.

A breaking belt tore off plaster in the dynamo room of the electric-light plant in Wadena, Minn., and made things lively for a few minutes.

A. Lant, the Iowa Central agent at Albia, Ia., has invented an automatic device for closing the circuit of a telegraph instrument. When the operator takes hold of the key the circuit is opened, and the instant the key is released, the circuit closes. With the device there is said to be no possible chance for a break in the current when the instrument is not in use.

The street-railway company of Omaha announces that the Q street line will be extended to Thirty-sixth street for South Omaha service.

A rusted-out boiler compelled a shut-down of a week in the electric-light plant at Corning, Ia.

Local capitalists have bought a controlling interest in the Tri-city Railroad company, operating street cars in Davenport, Rock Island and Moline. The system consists of 41 miles of electric lines. The company is remodeling and fixing its cars for the winter season.

The council of Moorhead, Minn., has appointed Mr. Markus superintendent of the electric-light plant at a salary of $80 a month. He agrees to do all the work the present superintendent is doing, and, in addition, do the collecting.

The electric lights for West Duluth, Minn., will hereafter be furnished from the power station in Duluth, of the Commercial Light and Power company. This change is made possible by the cutting off of so many street lights in the interest of economy, making the central power station equal to the additional work.

The street-railway company at Dubuque, Ia., is up against a condition, and not a theory, in the fact that it must pay an assessment of $3,000 for paving or lose its charter. Some time ago the company was anxious to get an extension of its charter—so anxious that it agreed to this section. Now the assessment of $3,000 is due and unpaid, and the company is in financial straits.

The electric-light plant and roller mills at Montevideo, Minn., have been sold to the James Quirk Milling company of Waterville, Minn., for $13,500. The Quirk company will operate the plant.

The Yankton, S. D., Council is looking into the matter of the cost of its electric-street lighting, the theory being that the city is paying too much.

The counterweight device for overcoming the grade on the Selby avenue hill in St. Paul is working very successfully, and the change from cable to electric power for the Selby avenue line is a gratifying improvement.

W. S. Russell has been granted a franchise for an electric-light plant in Glencoe, Minn. Work is to be begun at once.

A new electric-light plant is being installed at Watertown, S. D.

There is talk of constructing an electric car line between West Union, Ia., and Fayette.

The General Electric company asks the federal court for a judgment to enforce a lien against the Consolidated Gas, Electric and Steam Heating company of Davenport, Ia., amounting to $3,350. The lien was secured by four notes.

The Citizens' Traction company of Oshkosh, Wis., will investigate the charge of the water company that recent breaks in their pipes are due to electrolysis.

The Oshkosh, Algoma and Black Wolf Railway company has won its crossing fight with the Chicago and Northwestern Railroad company. The latter sought to prevent the electric company from making a crossing south of Oskosh. The electric company secured the appointment of a board of appraisement, but the railroad company went to the Supreme Court for a writ to review the proceedings of the lower court. The electric company moved to quash the writ, and the motion was granted.

The Fox River Valley Electric Railway company is still unable to come to terms with the council of Neenah. The company desires to extend its lines in order to form an interurban line, while the council wants a branch line constructed. The council may compel the company to equip the present horse-car line with electricity, in accordance with the terms of the original franchise. The company has taken steps to equip that part of the line which may be used in the interurban with electricity, and the city officials are watching to see that the bounds of the old franchise are not overstepped. If the company goes beyond the limit, at Church street, measures will be taken to stop it.

The Winona Railway and Light company of Winona, Minn., has taken up four blocks of track, owing to lack of patronage and inability to secure consent for a change of route to a line that would be profitable.

An arrangement has been made with the Fox River Valley Electric Railway company at Neenah, Wis., to run its cars into that town, superseding the horse cars. The council has been at outs with the railway company for a long time over a franchise.

People of Excelsior, Minn., hope that the probable extension of the electric line from St. Louis Park to Hopkins means that sooner or later it will be continued on to their village, and give them electric communication with Minneapolis.

A council committee at Winona, Minn., will investigate the feasibility of the city doing its own lighting.

General Manager Herbert Warren of the Duluth Street Railway company at Duluth, Minn., has resigned. He will probably be succeeded by S. T. Norrell, at present manager of the Superior system.

The Hughes Electric company announces that its plant at Fargo, N. D., will be ready for operation soon.

The Postal Telegraph company is about to extend its wires to Spokane, Wash., and there is considerable curiosity as to which point they will come from. The company has connections well into Montana and also has a line paralleling the Canadian Pacific railway to the coast. It is believed that a short line will be run down from Rossland, B. C., to Spokane.

The State Board of Equalization for Minnesota has decided to allow the assessments of the telegraph companies to remain the same as last year, $865,500 for the Western Union and $60,500 for the North American. The board had proposed a raise, but the companies' protests effected a reconsideration. The board also decided upon consideration not to raise the assessment of the Twin City Rapid Transit company in Minneapolis and St. Paul. Governor Clough intervened in this matter personally and urged that the present assessment was high enough.

The council committee on ways and means of Minneapolis is said to be determined to force a reduction in the price for street lighting from the Minneapolis General Electric company. If the company refuses the committee will recommend that the resolution before the council, to submit the matter of a municipal electric plant to popular vote, be passed.

T. C. Libbey has shut down his electric-light plant at Britton, S. D. He may sink an artesian well to secure power.

The Stevens Point Lighting company of Stevens Point, Wis., has gone into the hands of V. P. Atwell as receiver.

The Cushman company of Waterloo, Ia., levied on a street car of the Waterloo and Cedar Falls Rapid Transit company, to recover on a judgment for $95.86.

The Beloit (Wis.) Electric Light company recently gave a reception and ball in its new power station, as a house-warming. The company has spent $40,000 in improvements this year. C.

Detroit, Mich.

Detroit, October 17.—A strike upon all the street-railway lines in the city was narrowly averted by Mayor Maybury a few days ago. It appears from the annual reports of the street-railway company that the three-cent lines here have been a losing venture. At least the stockholders claim that they are not receiving a fair return on their investments. When the yearly agreement between the company and the Street Railway Employes' association came up for arrangement the last time the company proposed that on the three-cent lines the wages should be cut from 21 to 19 cents an hour. This the men would not agree to, and it was only by the mayor's efforts with those in control of the stock that the company was influenced to recede from its position. Since then the agreement has been signed and the company will try to cut the expense in other directions.

The Postal Telegraph company has a small dispute with the Michigan Land company, over the stringing of wires and poles on the company's land. It will be settled in court at this term of the Wayne Circuit Court.

The Western Union has finished laying all conduits within the half-mile circle, and before the first of the year all its wires will be underground.

The recent fire in the Michigan Electric company's establishment caused a beautiful electrical display in the alley. The Western Union Telegraph company occupies a building just to the right of the fire, across the alley, and several hundred wires and cables led past the store. When the firemen cut the wires they fell in among one another, and sheets of flame lighted up the alley through the dense smoke. The Michigan Electric company has a corps of men already at work, and will soon have a new and complete electrical plant installed in its old building. G.

Canadian Intelligence.

Ottawa, October 15.—The city engineer of Toronto, Ont., has refused to draw specifications for a 6,000 horse power municipal power plant, as ordered by the City Council, and has recommended that $1,000 be appropriated to secure the services of an expert consulting electrical engineer, who shall prepare the specifications.

It is reported that the Fredericton Electric Power company of Fredericton, N. B., is negotiating for property upon which to build a new power house.

A scheme is on foot in the county of Halifax, Nova Scotia, to construct an electric railway from the town of Waverly to the city of Dartmouth, and from that point to Musquodoboit Harbor.

George T. Simpson, electrician of Hamilton, Ont., is under arrest for stealing electricity from the Electrical Power and Manufacturing company of that city. It is charged that Mr. Simpson unlawfully consumed electricity belonging to the company, and that he also destroyed and removed electric wires which were the property of the company.

The first meeting of the directors of the Metropolitan Electric Light company of Ottawa was held a few days ago and the company's application for incorporation appears in the Canada Gazette. As soon as the charter is secured, operations will be commenced in the construction of the plant, and the intention is to be in a position to furnish light within six months.

The city of Toronto, Ont., wants bids by Wednesday, November 9th, for the supply of a complete electric-lighting plant, or for the various portions of the work, namely, engine equipment, countershaft and pulleys, belting, boilers, feed pumps, and condensers, water and steam piping, economizers, dynamos and station electrical apparatus, arc lamps, mast arms and lamp attachments, poles and overhead circuits, conduits and cables.

Mr. E. C. Jenison is promoting a scheme to build a water-power canal from above the Ecarte Falls, on the Kaministiquia River, to the boundary of Port Arthur, where an immense storage reservoir will be built. The intention is to supply electric light and power to Port Arthur, Fort William and other towns in the vicinity. The immediate expenditure on the canal would be about $1,000,000. The town of Port Arthur has made arrangements for the supply of 560 electric horse power and 500,000,000 gallons of water per annum from the power canal. The contract is to be submitted to the taxpayers for their approval at once, and Mr. Jenison agrees to have the works completed within three years.

A United States company, which is going to develop the water power in the Jacques Cartier River, in the province of Quebec, for electric-light and power purposes, for Quebec city, in opposition to the Montmorency company, has now acquired the chartered rights, for the city of Quebec, of the Standard Light and Power company of Montreal. The American company has a capital of $500,000 and its president is Emerson McMillin of New York.

The Niagara Central railway has been bought by Haines Brothers of New York. The road will be converted into an electric road, and it is said there will be a 40-minute service between St. Catherines and Niagara Falls. The trestlework at Merritton, Ont., and Thorold will be done away with, and the road run on the ground, the motor cars being able to overcome grades which the steam cars could not. The plans also include the extension of the road.

The West Kootenay Power and Light company, which is building a parallel line of wires between Rossland, B. C., and the generating plant at Bennington Falls, has the right-of-way cut and poles on the ground for most of the distance. The right-of-way has been cut clear of everything for a width of 100 feet, and all the tall trees outside of that area, which, if they fell, would injure the line, have also been cut down. The insulators will be housed so as to keep out the snow in winter. The idea in constructing the second line is that if one line goes down the other can be made use of, and interruption of the service prevented.

A decisive step has been taken in the development of the power at Shawinigan Falls on the St. Maurice River, in the province of Quebec. Although little has been made public in regard to the plans of the Shawinigan company, the work is being pushed forward as rapidly as possible. The company's engineers have for months been preparing plans for what eventually will be the greatest power development in Canada. Last week the company awarded to Messrs. Barry, Ross & McRae, of Niagara, contracts to cover the canal, power house, etc., for a plant of 30,000 horse power. The company's plans, however, cover several times that amount of power. It is proposed to convey electric power to Three Rivers, 20 miles distant, and other points within reach of the falls. The company will spend $1,000,000 at present.

W.

PERSONAL.

Professor F. B. Crocker of Columbia University and the Crocker-Wheeler Electric company has left New York for the Pacific coast, whence he will start on a tour around the world, partly on business and partly for recreation. Professor Crocker is enjoying a year's leave of absence from the university.

William A. Smith of Liverpool returned to England last week after a stay of several days in Chicago. During his visit he was in close consultation with the managers of enterprises in which English capital is largely interested. Mr. Smith is a director in the National Telephone company of England, and made an inspection of the property of the Chicago Telephone company during his visit.

ELECTRIC LIGHTING.

The time for opening proposals for the installation of an electric-light and power plant at the United States naval station at Puget Sound, Bremerton, Wash., has been postponed from October 15 to October 29, 1898, by order of the chief of the Bureau of Yards and Docks of the Navy Department, Washington, D. C. Intending bidders desiring to bid on this contract may obtain full particulars by addressing the above-named officer. The sum of $9,800 is available for this work.

ELECTRIC RAILWAYS.

The street cars of Chicago are now equipped, or being fitted, with fenders.

A double-track electric railway is planned to connect the central portion of Stockton, Cal., with the racetrack and the projected park on the Calveras River.

Recently a force of workmen at Oakland, Cal., has been clearing the right-of-way which the Southern Pacific Railway company secured about two years ago for an electric railway from Twenty-third avenue to Laundry Farm, and it is believed that work on construction of the road is to be commenced at once.

The September report of the receiver of the Chicago Metropolitan Elevated shows the daily average traffic of that road last month to have been 60,455 passengers. This is an increase of 2,914 as compared with the preceding month. The loop rental for the month amounted to $11,120 against $11,111 in August.

The Trieste (Austria) Tramway company has received from the authorities of the city of Trieste permission for the introduction of electric power on the company's lines; also a concession has been obtained for five kilometers of new line. At present the proposition is before the minister of railroads, and the company hopes to begin the work soon.

TELEGRAPH.

According to the daily papers, Mr. Mohun, an American, has just left Brussels, accompanied by five trained electricians, to extend the telegraph in the Congo country from its present terminus at Stanley Pool to Stanley Falls, and thence in two different directions to Lake Tanganyika, on the one side, and to Redjaf, on the Nile, on the other. The work is to cost about $500,000, and it is expected that it will be completed in 1900.

ELECTRICAL SECURITIES.

The Nashville Street Railway company of Nashville, Tenn., has called for redemption the $149,400 bonds of the McGavock and Mount Vernon Horse Railroad company, and these bonds will be paid at par at the First National Bank of Nashville. An equal amount of Nashville Street Railway five per cent. bonds has been issued, raising the outstanding issue to $633,400.

The Bridgeport Traction company reports gross earnings for September of $32,987, an increase of $4,479, as compared with the same month of last year, and net $17,121, an increase of $1,705. For the three months ended September 30th the gross earnings were $108,214, an increase of $15,332, as compared with the corresponding period of last year, and net $57,104, an increase of $7,395.

PUBLICATIONS.

The Farr Telephone and Construction Supply company of Chicago has just issued a new monthly bulletin which gives much information to telephone users. Many new products are illustrated in this bulletin, and readers of the Western Electrician interested in telephone work will do well to write for a copy of the bulletin.

The new catalogue of the Lombard Water-wheel Governor company of Boston gives a general description of the governor for water-wheel regulation which is manufactured by the company, with data obtained from actual practice. Testimonials show the value of the governor in regulating the speed of water-wheels used for driving electrical generators and for other purposes. It is claimed that the Lombard governors rank with the highest grade of machinery "made in any country for any purpose."

The Western Electrical Supply company of St. Louis, Mo., is just issuing a new and complete house-goods catalogue, No. 18A, which will be ready for distribution in about 10 days. This company has, it thinks, many flattering inducements to offer in the house-goods line, and it is its constant aim to keep pace with the times. The Western Electrical Supply company, upon receipt of address, will take pleasure in sending a copy of the book, as soon as it is issued, to anyone interested in electrical house goods.

Steel casting are used by many builders of electrical machinery for motor and generator frames, gears, etc. The American Steel Casting company of Thurlow, Pa., claims to have the largest and best equipped plants in the United States for the manufacture of steel castings of all descriptions. It issues an attractively illustrated catalogue.

Active missionary work in the field of domestic illumination is still necessary to retain and broaden the field for the use of the electric lamp. The incandescent gas mantle became undoubtedly popular immediately after its introduction, and not until the public had purchased its experience was it willing again to listen to exact information regarding the real significance of the mantle. The General Electric company has done much to give accurate information to the public, expending considerable sums of money in test and experiment and publishing the results at its own expense. It has just issued a dainty pamphlet on the "Depreciation of Candle Power of Welsbach Mantles," giving the result of interesting tests made both in mantles and electric incandescent lamps. It contains information of use to every electric-light station manager, as well as to the general public, and will be sent by the General Electric company to anyone interested, on application.

MISCELLANEOUS.

Monterey, the most prosperous city in Mexico, has a population of 73,000 people. It is lighted throughout with electricity and is well equipped with telegraph and telephone service and has good street-car lines.

The War Department, through the Signal Office, has asked for sealed proposals for furnishing the Signal Service with 50 miles of stranded wire, naked, seven-ply; 50 miles stranded wire, insulated and braided, seven-ply; 350 miles No. 9 galvanized iron wire; 300 miles No. 14 galvanized iron wire; 3,000 double-petticoated porcelain insulators.

By direction of the paymaster-general of the navy, the opening of proposals for furnishing the Norfolk, Va., navy yard with one electric traveling crane, was postponed from October 18th to October 29th. Contractors desiring to bid on this work can obtain full particulars by addressing the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

TRADE NEWS.

The Columbia Incandescent Lamp company of St. Louis has completed its improvements and increased its output about 25 per cent., in order to keep up with the large demand. Owing to the increased output, the company has been compelled to operate the factory at night.

M. I. Vought, the well-known electrician, located at La Crosse, Wis., states that he has secured the contract for the electrical work in the new Episcopal Church in that city. Armorite conduit is to be used, and Mr. Vought says that this will be the first installation of this kind in that part of the Northwest.

At the annual meeting of the stockholders of the Electric Third-rail and Signal company, in St. Louis, the following-named directors were elected: D. Wishart, B. Eiseman, S. L. Swarts, A. M. Sullivan of St. Louis, and P. J. McNamara of Fort Smith, Ark. The board of directors organized by electing D. Wishart president, S. L. Swarts vice-president and B. Eiseman secretary and treasurer. Negotiations are pending whereby the protected electric third-rail and signal system of the company will be introduced on a prominent steam railroad, to demonstrate the practicability and effectiveness of handling suburban passenger traffic by electricity on the track of the steam roads without interference in the operation of steam trains on the same track.

BUSINESS.

One advantage claimed for the Jandus enclosed alternating-current arc lamp is noiseless mechanism. This lamp is also provided with a reflector which increases the illumination and decreases the heat transmitted to the mechanism from the arc. The Chicago office of the company manufacturing this lamp is at 753 Monadnock building. A catalogue is sent for the asking.

The Berlin Iron Bridge company, East Berlin Conn., is erecting the extension of the foundry for the Benjamin Atha & Illingworth company at Harrison, N. J. This extension is 51 feet wide and 152 feet long. The framework is of steel throughout. The sides are covered with corrugated iron on steel purlins, and are arranged for suitable doors and windows. The side columns support a 30-ton electric crane, having a span of 46 feet. The roof construction is of steel trusses and purlins arranged with openings in the roof for skylights.

The Mica Insulator company of New York, Chicago and London, manufacturer of Micanite materials for high-grade insulation, reports a gratifying demand for its commutator rings. It makes a spe-

cialty of manufacturing molded insulation and is now turning out, for some of the large manufacturers of electrical machinery, molded rings all in one piece. This pattern of ring is the most difficult installation to manufacture. But the ring, as it comes from the machinery of this company, is said to be as perfect as a stamped piece of steelware, and has the same metallic ring. Another form of insulation of which this company has made a specialty is the armature trough or slot, which is now in use by many of the manufacturers of motors for crane work and by those who require a heavy insulation which will stand at very high voltage. While this form of insulation is a trifle more expensive than the common red paper and mica, yet those concerns who manufacture machinery which receives such rough usage have found it necessary to get the best possible insulation for their armatures.

ILLUSTRATED ELECTRICAL PATENT RECORD.

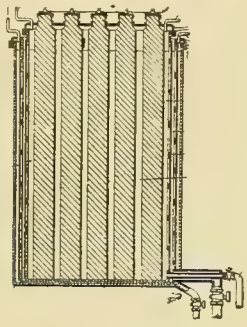
Issued October 11, 1898.

612,009. Process of and Apparatus for Electrolyzing Sea-water. Giovanni B. Baldo, Trieste, Austria-Hungary. Application filed October 5, 1896. Patented in England March 6, 1896; in Austria April 6, 1896, and in Belgium July 15, 1896.

The process described of electrolyzing sea-water consists in decomposing two bodies of the same, at the anode and cathode respectively, in presence of a body of fresh water on the opposite side of the cathode to the sea-water, such bodies of sea and fresh water being separated as against circulation, but not against the action of the current, precipitating magnesium and calcium hydrates at the cathode, while the sodium produced at the cathode is oxidized by the fresh water forming caustic soda therein.

612,015. Lightning Arrester. Cummings C. Chesney, Pittsfield, Mass. Application filed January 15, 1898.

When alternating currents are employed the arrester is combined with a coil where in different portions which are in inductive relation to each other the alternating current flows in opposite directions, the coil being in series with the line and the apparatus to be protected at a point between the lightning arrester circuit and the apparatus.



NO 612,009.

612,038. Electric Switch. Gerald W. Hart, Hartford, Conn. Application filed October 23, 1896.

An electric switch consisting of a base of insulating material, contacts mounted thereon and operating mechanism having a switch plate in operative relation to the contacts, the base being cup-shaped and having in its outer walls open grooves leading from the bottom of the base to the contacts.

612,049. Arc-lamp Globe. Henry G. Mills, Milwaukee, Wis. Application filed May 10, 1897.

A globe for lamps comprising a globe proper having upper and lower open ends, and an annular pendant flange at the lower end of the globe, and a plurality of horizontally arranged lenses below the horizontal center of the globe and formed integral with the globe proper and the annular flange and arranged concentrically about the latter in a horizontal plane with their optical axes disposed vertically.

612,062. Trolley Arm. Benjamin R. Shopp, Jr., Jersey City, N. J. Application filed March 15, 1894.

This combination includes a trolley wheel consisting of an elongated roller and inclined guides located at each side of the trolley arm and inclining in direction of the length of the roller, the guides leading to the upper surface of the roller at the ends thereof, whereby the wire at a crossing will be taken up by the trolley at one side thereof and discharged from the trolley at the opposite side.

612,063. Switching Mechanism. George W. Singleton, Syracuse, N. Y. Application filed January 18, 1897. Renewed March 5, 1898.

A tract is provided with a frog having a movable switch point, electrically operated means for actuating the switch point, a vehicle movable along the track and provided with an electric switch for controlling the operation of the electrically operated means, connections between the electric switch and the electrically operated means, and a signal connected in shunt to the circuit between the electric switch and the electrically operated means for indicating the potential of the electric current for actuating the electrically operated means.

612,068. Electric Railway. Frederick D. Sweet, Elyria, Ohio. Application filed November 22, 1897.

Stationary contact boxes are arranged along the track and have smooth upper surfaces, combined with a brush formed from a number of loosely swinging plates pivoted at their upper ends which extend at right angles to the forward movement of the car, and which form frictional contact with the tops of the boxes.

612,122. Electrical Converter. Ferdinand Schwedtmann, St. Louis, Mo. Application filed August 28, 1897.

A suitable casing is provided for the reception of the core, the casing communicating with the external atmosphere at or near its top, and an air passage or passages communicating with the casing at its bottom and with the external atmosphere at a point intermediate between the bottom and top of the casing, whereby the converter may be used either with or without a liquid.

612,123. Electrical Connector. Ferdinand Schwedtmann, St. Louis, Mo. Application filed November 11, 1897.

This connector consists of an inner and an outer member, having smooth contact surfaces, one of the members being tubular and slit along a portion of its length to form a plurality of tongues or strips and an annular spring for forcing the tongues or strips against the other member, the annular spring having its axis coincident with the axis of the tubular member.

612,132. Electric Trolley Device. Charles L. Jeffrey, Johnstown, Pa. Application filed January 12, 1898.

A trolley arm is normally prevented from lateral movement by suitable locking devices but normally free to swing in a vertical plane, and means are provided for releasing the locking devices, in combination with mechanism for preventing the vertical movement of the arm, the mechanism being operated by a lateral movement of the arm, when in a predetermined vertical position.

612,139. Casing for Electric Car-lighting Apparatus. Willard F. Richards, Buffalo, N. Y. Application filed November 26, 1897.

The dynamo is supported by the car-body; driving mechanism is provided for transmitting motion from the car-axle to the dynamo, and a casing inclosing the driving mechanism and composed of a front section mounted with its front portion on the car-axle and having its rear portion pivotally supported on the track frame, whereby the front end of the section is permitted to rise and fall with the car axle, and a rear section having a flexible connection with the front section and mounted with its rear portion on the dynamo.

612,146. Electric System of Distribution. Joseph N. Thomas, Johnstown, Pa. Application filed February 15, 1898.

The combination is claimed of the disconnected contacts, a junction box opposite each disconnected contact, a subfeeder normally continuous throughout its length, but composed of a plurality of sections connected together within each junction box, and a contact feeder connected in each junction box to the subfeeder and terminating at its other end at the corresponding disconnected contact.

612,152. Electric-lamp Socket. Frank M. Bell, New York, N. Y. Application filed January 10, 1898.

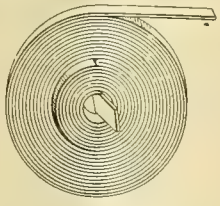
A socket comprising a casing, a base of insulating material arranged therein, a central contact and contact fingers arranged upon the base, and a spiral supported by the contact fingers.

612,172. Telephone Arm Rest. James R. McKelvey, Lawrenceville, Ga. Application filed August 23, 1897.

A bracket consisting of horizontal bars spaced apart and connected at their outer ends and having their opposing edges smooth, a vertical bar connecting the inner ends of the horizontal bars and having its ends projecting beyond them, forming pivotal supports, and having a slot opposite the space between the horizontal bars and extending from the inner side of one bar to the inner side of the other bar, and lugs at the outer ends of the horizontal bars disposed at opposite edges thereof and extending into the space between them, the parts being constructed to admit of an advertising card being slipped through the slot of the vertical bar and between the oppositely disposed lugs and held in place thereby.

612,192. Hinge Conductor for Electric Currents. Frank E. Chandler, Brandon, Vt. Application filed January 8, 1898.

A hinge for doors has a hollow pintle, in combination with an electric conductor of unbroken continuity, the ends of which are secured to opposite wings of the hinge, so as to bring the intermediate portions of the conductor within the hollow pintle.



NO. 612,015.

612,203. Controlling Switch for Electric Motors. Reese Hutchison, Mobile, Ala. Application filed February 17, 1898.

The combination includes a supply circuit and two or more electric motors in separate branch circuits, a multiple contact switch and electrical connections between points in the switch and the terminals of the motor branches whereby the branches may be connected in series or in parallel arrangement, a locking device for the switch, and an electromagnet to control the locking device, having its coils included in one of the motor branches.

612,212. Rheostat. Edwin O. Raster, Chicago, Ill. Application filed April 11, 1898.

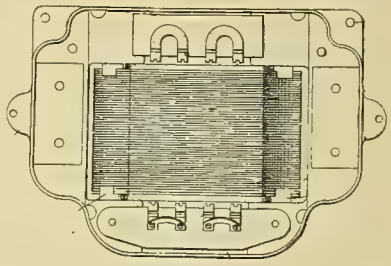
A rheostat or heater comprising a frame is adapted to receive a plurality of sets of resistances, each of which comprises a plurality of resistance sticks alternated with contact and insulating pieces, and means for clamping the sets of resistances in the frame comprising devices mounted in one member and adapted to bear against the sets of resistances and clamp same against another member of the frame.

612,219. Telephone Central-station Apparatus. Julius H. West, Berlin, Germany. Application filed July 8, 1896. Patented in France May 7, 1896; in Switzerland June 4, 1896; in England June 5, 1896; in Hungary June 5, 1896, and in Austria September 2, 1896.

The combination of telephone lines, springjacks therefor at several switchboards, to which the lines are connected, an annunciator for each line and normally connected therein, a visual indicating signal for each line, one terminal of each indicating signal being normally connected to a source of electricity, the other terminal being connected to two circuit-controlling devices, one controlled by the operation of an annunciator, the other, forming a part of a springjack, being controlled by insertion of a plug in the jack.

612,234. Electric-traction Apparatus. Raoul Demeuse, Brussels, Belgium. Application filed July 23, 1897. Patented in Belgium December 28, 1896; in France April 24, 1897; in Switzerland May 10, 1897; in Spain May 11, 1897; in Portugal May 13, 1897; in England May 17, 1897; in Denmark May 17, 1897; in Sweden May 17, 1897; in Norway May 17, 1897, and in Italy May 29, 1897.

A current collector for electric railway systems is described comprising a plurality of parallel plates or bars separated by interposed spacing washers, and secured by a transverse bolt passing through elongated slots in the plates or bars, in combination with a buffer interposed between the plates and the vehicle, a supporting bracket on either side of the plates, and resilient suspending means for the brackets.



NO. 612,122.

612,236. Circuit Controller and Receiver Support. Luis Duque, Paris, France. Application filed August 21, 1897. Renewed June 9, 1898.

The arm is made of two members hinged together, one of which is constructed to support a telephone receiver, and the other to be fastened in a fixed position; a coiled spring is fixed at its ends to the members, for moving the former; a lever is pivoted to the movable member; a bar is connected at one end to the latter, and at the other end to the fixed member, and a rod is attached to the lever, to connect the same to the telephone circuit opening and closing mechanism.

612,250. Process of Electrolytic Separation of Metals. Heinrich von der Linde, Crefeld, Germany. Application filed November 19, 1897.

A process for removing the plating from articles made of iron for the purpose of making the remaining iron capable of being used in the manufacture of steel is described, consisting in subjecting articles of iron which are plated with a solid coating of a metal forming a soluble carbonate as nickel, and employed as anodes in a depositing cell to the action of an electric current in a bath of ammonium carbonate, whereby the metal forming the plating is dissolved and is precipitated upon the cathode while the iron remains unaffected.

612,326. Electric Battery. Manes E. Fuld, Baltimore, Md. Application filed August 4, 1897.

This battery cell has non-conducting separating plates supported by the elements of the cell approximately at the upper and lower ends of the elements and separating them from each other and holding them at a fixed distance apart, the plates each being recessed at one end, where they contact with the cell to compensate for expansion.

612,330. Telephone Pay Station. William Gray, Hartford, Conn. Application filed November 21, 1895.

One claim is given: In combination the signal box, the signal device located within the box, the hollow post located over an opening in the wall of a box, the transmitter case pivotally attached to the post, the stop limiting the swinging movement of the transmitter case on its pivot, the curved deflector tube rigidly attached to the transmitter case, and extending within the post through an opening in the wall thereof.

612,344. Underground Electric Railway. Charles W. Jenkins, Richmond, Va. Application filed October 28, 1897.

A conduit having lateral hand-holes and provided with the side beams spanning such hand-holes, and with the transverse beams supported at their ends on the side beams midway between the ends of the latter.

REISSUE.

11,697. Conduit-outlet Insulator. Frederick W. Erickson, Boston, Mass. Application filed June 25, 1898.

An outlet insulator for conduits consisting of a hollow metallic member adapted to be connected to the metallic pipe of the conduit, and an insulating member enveloping the outer and inner surfaces and the end or edge of the metallic member opposite to the end which is attached to the conduit pipe.

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Electrical Illumination at the Peace Jubilee.

A lavish use of incandescent lights for decorative effects at night was made at the Peace Jubilee in Chicago last week. As the accompanying illustrations show, no great novelty in design was attempted. The municipal arch was well proportioned and made a particularly pleasing picture at night, with its graceful outlines glowing in lines of light. Aside from this feature, the general effect was that of a great volume of light on the principal downtown streets from strings of incandescent lamps in overhead festoons and in a great variety of combinations on the building fronts and projecting signs and decorations. The effect was striking and brilliant—much more so than any idea conveyed by the pictures—and it met the enthusiastic approval of the spectators who braved the miserable weather of the greater part of the week to see it.

The electrical illuminations fell into three clearly defined clases—the municipal arch (Figs. 1 and 2), the overhead festoons (Figs. 3 and 4) and the private decorations (Figs. 6, 7 and 8). In view of the inclement weather, it was particularly fortunate that the electrical display was so extensive, as the wind and rain greatly damaged the effectiveness of the flags, bunting, evergreen and some of the arches, but had no ill effect on the incandescent-lamp decorations.

Municipal Arch.

Unquestionably the most artistic and attractive jubilee decoration was the municipal arch, erected at La Salle and Washington streets. This structure is depicted in the architect's drawing reproduced on page 240 (Fig. 2), while the night effect is shown in the photographic picture on this page. This arch was doubly an electrical feature. It was the only one electrically illuminated and it was erected by the electrical companies and presented to the city. Originally the City Council appropriated $2,000 to erect a municipal arch for the jubilee, but it was discovered that, under the city charter, the aldermen had no right to set aside any portion of the city's funds for such a purpose. In this dilemma the Chicago Edison company, Western Electric company and General Electric company came to the rescue and offered to erect jointly the arch and present it to the city. The offer was accepted by Mayor Harrison with thanks; and in this manner it came about that the municpal arch was such a distinctively electrical affair. John E. Youngberg was the architect selected to design the structure, which was erected under the supervision of J. H. Goehst.

The arch was 50 feet wide, 40 feet high and 11 feet thick, and the opening was 35 feet wide and 22 feet high. It was built of wood, after the manner of the World's Fair buildings. It rested on the street pavement, and to give it stability each of the hollow piers was ballasted with four tons of masonry supported by the wooden framework of the structure.

The general color of the frame was white. The ornamentation consisted of oil paintings of battle scenes, portraits of the president and war heroes, plaster figures and implements of war in relief and suitable inscriptions. In addition the outlines were studded with incandescent lamps, which greatly enhanced the night effect.

La Salle street was spanned by the arch, so that the principal fronts faced north and south. In both pictures the north side of the arch is shown. The topmost inscription, boldly painted, was "Chicago's Tribute to the Army and Navy." Beneath the cornice, across the entablature, was a row of portraits of army offices. Beginning at the left the men represented were Colonel Kavanaugh, Colonel Moulton and Colonel Turner, the commanders of three of the Illinois volunteer regiments; General Shafter, to whom Santiago surrendered; General Brooke, distinguished in the Porto Rico campaign; General Lee, the former consul-general at Havana and afterward major-general of volunteers, and Colonel Marshall, the commander of the Illinois regiment of Negro volunteers. Each portrait was surrounded by a garland in relief, and between the pictures were stacked rifles, entwined with cartridge-belts, also in relief. The large portrait, at the keystone of the arch, is that of General Miles, the commander-in-chief. All the portraits were carefully executed in oil and were excellent likenesses, as may be judged by an inspection of Fig. 1. This photograph was taken at night, of course, but there was a sufficient volume of light to make the portraits clearly distinguishable in the picture, although much of the effect is lost in the half-tone. This would not be remarkable in the case of arc-light illumination, but is worthy of note in a case where the yellow light of incandescent lamps is used. The battle scenes shown were the fields of El Caney (on the left) and San Juan (on the right). Above them were sculptured figures of the Goddess of Victory, with trumpet and laurel wreath.

The southern side of the arch was especially devoted to naval officers and naval scenes. The smaller portraits in this case were of Captain Clark, Lieutenant Hobson, Admiral Schley, Admiral Dewey, Admiral Sampson, Captain Evans and Lieutenant Wainwright, naming them from left to right. The large portrait was of President McKinley, and the naval battles depicted were those of Manila Bay and the destruction of Cervera's fleet off Santiago.

On the end elevations of the arch were portraits of General Chaffee and Captain Philip, with inscriptions, written by the mayor, praising the work of the soldiers and sailors. That on the east end read as follows:

Chicago salutes the heroes of the army and swells the hallelujah that hails their return from camp and trench and field—heroes

FIG. 1. ELECTRICAL ILLUMINATION AT THE PEACE JUBILEE.—NIGHT VIEW OF THE MUNICIPAL ARCH.

whose valor in action and fortitude in hardship have won tributes from every land. Hurrah for the American soldier—the young and old, the Blue and the Gray, who shouted "Ready" when the nation called!

For the sailors the inscription on the west front was prepared. It was as follows:

Chicago salutes the heroes of the navy and joins the chorus of jubilation over their triumphs for the flag—triumphs that have set the world thinking and given the nations a new conception of American power, skill and daring. The memories that cluster around Manila Bay and Santiago Harbor will live as long as heroism is honored and heroes are rewarded.

Illumination of the arch was secured by about 1,000 clear-glass lamps of 16 candle power each, placed, as indicated in Fig. 1, to give the upper outlines of the arch and light the pictures. The lamps were wired on the three-wire system and were supplied with current from the isolated plant in the city hall, about 250 feet distant. Connections were arranged so that, in case of necessity, the lamps on the arch could be supplied from the street mains of the Chicago Edison company. Simplex wire was used for this and much of the other jubilee work, and some of it was donated for the occasion through the efforts of H. R. Hixson.

Overhead Lamp Festoons.

Yellow ropes of light, made of incandescent lamps, and caught up in the middle in the manner shown in Figs. 1, 3 and 4, were strung across all the streets selected for the line of march. It was a simple expedient but it was very effective, and where an uninterrupted vista of the festoons could be had the effect was very pretty. About 9,000 16 candle power lamps were suspended over the streets in this manner, and, with the ordinary arc street lighting and the private electric-lighting devices, the streets beneath were almost literally as light as day. The lamp festoons were distributed along 22 city blocks, and four was the average number to a block. Each "rope" was composed of from 80 to 120 lamps, the number varying with the width of the street.

Current for the lamp festoons was supplied by the street mains of the Chicago Edison company. Feed wires were tapped into the mains and carried up the fronts of buildings and over signs and fastened to four-by-four-inch timbers placed across window openings, usually on the third story. In the windows above, and in a similar manner, were fastened the ends of galvanized-iron cables which were stretched taut across the street to support the lamps and conductors of the festoons. These span-wire cables were stranded of two No. 4 B. & S. wires. The center of each festoon was suspended from its span wire by a porcelain roller. Thus the apex of the festoon was at about the level of the fourth-story windows—about 45 feet above the pavement—and the ends sloped down to the third-story windows, where connection was made with the risers from the street mains.

The two conducting wires of each festoon were of No. 6 or No. 8 B. & S. gauge and rubber-covered. The lamps were supplied with the rain-shield shown in the sketch (Fig. 5, p. 242), and as this guard was of tin the under surface served the purpose of a reflector. It would have been impossible to have obtained the large number of weatherproof sockets needed in the limited time available, so Mr. Goehst devised the simple protection shown for temporary service. It answered the purpose well, and enabled ordinary sockets to be used out of doors during a rainy week. The rain-shield was simply the inverted body of an ordinary tin cup 4½ inches in diameter and two inches deep fastened over the base of a brass, screw-threaded socket and provided with an opening for the conducting wires. This protector was made water-tight on top by tape and insulating paint, and the job was done.

There were two service taps in each block for the festoons, two festoons being fed from each service. The controlling switches were placed in storm boxes beneath the show windows along the sidewalk, and patrolmen were sent out to turn the lights on and off. The lamps burned from 6:30 until 11:30 p. m. In the case of burned-out lamps the string of lamps was pulled into the window nearest the defective lamp, the porcelain-roller support on the span wire permitting this movement.

The installation and operation of the overhead festoons of light was entrusted to the Chicago Edison company by the citizens' jubilee committee on decorations. The work of construction was done in 10 days.

Private Decorations

The private electric-light embellishments were of great number and variety. Nearly every important business house along the line of march had some design in lamp bulbs to add to the general effect after nightfall. A number of designs employing colored lamps were noticeable, although the general preference seemed to be for clear-glass or frosted globes. On Tuesday night, October 18th, the Chicago Edison company carried the heaviest load in its history—46,000 amperes—sufficient to supply 115,000 lamps burning at once. In addition, many of the electrical decorations were supplied from private sources of current, such as the municipal arch, as already mentioned, the designs on the Union Loop structure and many others.

Three of the private displays are shown in the illustrations. Siegel, Cooper & Co.'s great granite building was conspicuous by long ropes of light (Fig. 6) converging at the entrance and extending to the farthest corners of the State street front. A large electrical sign, high up, added to the effect. The corner shield of Mandel Bros. at State and Madison streets (Fig. 7) was very large and effective. It was about 35 feet high and visible for a long distance. The Chicago Edison company's building on Adams street (Fig. 8) had a sign in frosted lamps that was particularly appropriate to the Peace Jubilee and explains itself. It attracted much attention.

One result of the jubilee was to call renewed attention to the decorative possibilities of incandescent lights. Many of the State street merchants were loth to lose such a fine attraction, and the proposition to leave the festoons over that thoroughfare for a month to come was debated after the jubilee, with a fair prospect that enough adherents would be secured to insure the success of the scheme. At any rate, it is certain that the electric light will play an increasingly important part in all street decoration schemes in Chicago.

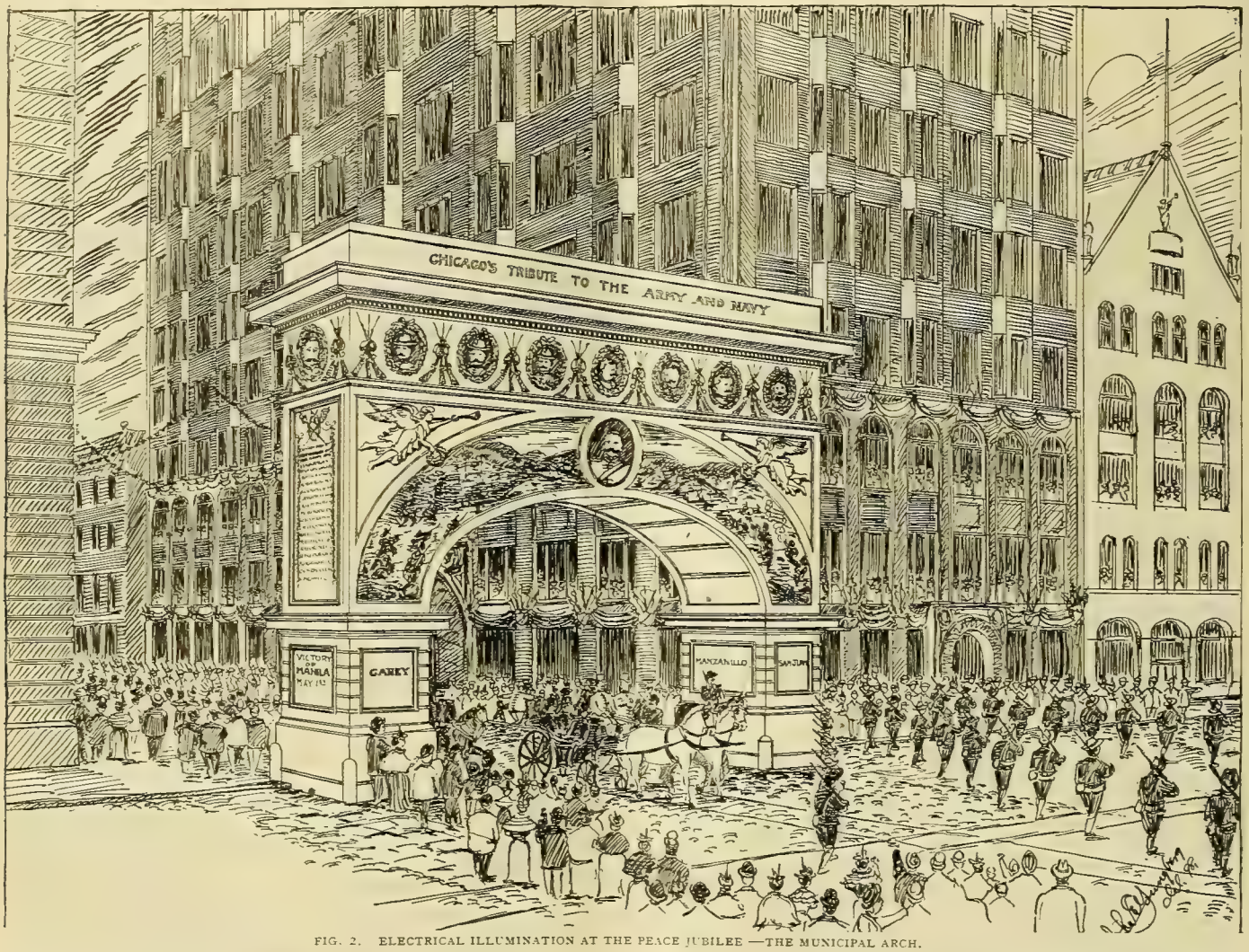

FIG. 2. ELECTRICAL ILLUMINATION AT THE PEACE JUBILEE —THE MUNICIPAL ARCH.

Jubilee Street-railway Traffic.

Despite the inclement weather of jubilee week the Chicago street-railway companies did a greatly increased business. Wednesday, October 19th, was Jubilee Day proper, the day of the parade, and was the best day of all for traffic, although it was rainy and disagreeable. On the elevated roads all previous traffic records since Chicago Day at the World's Fair were broken. The figures of passengers carried on Wednesday, compared with the normal average traffic, are as follows: Metropolitan West Side elevated railway, 162,000, against the usual average of 70,000; South Side elevated railroad, 129,415 and 50,000; Lake Street elevated railroad, 75,894 and 35,000. The surface roads did not enjoy a corresponding increase in traffic, although the volume of their business was swollen. During the hours of the parade the surface cars were not allowed to run in the downtown district, and this diverted traffic to the elevated lines. The grand total for the day for all surface and elevated lines is placed at 1,416,300. Steam-railroad men estimate that 200,000 visitors from out of town attended the jubilee.

Equipment and Maintenance of Electric Cars.

By M. S. Hopkins.

Part II.

Electrical Equipment.

In the selection of electrical equipment the main point is to secure equipment of ample capacity and proper design for the service required. In a railway motor the mechanical and electrical features which influence its maintenance should receive very careful consideration. The bearings should be large and lubricated by oil from below and cup grease from above, and so designed that drip from the

FIG. 3. ELECTRICAL ILLUMINATION AT THE PEACE JUBILEE.—STATE STREET AT NIGHT, LOOKING SOUTH FROM WASHINGTON STREET.

bearings will fall outside of the frame. The armature should be so constructed as to permit the shaft being pushed out without disturbing the commutator and winding.

I am glad to note that the importance of light weight and slow peripheral speed of armature has been recognized in recent designs of railway motors. The inertia or flywheel capacity of the armature should be the smallest possible consistent with the work required. Engineers differ as to the best method of suspension. From a theoretical standpoint, the cradle or side-bar suspension has the lead. The dead weight is largely removed from the axle, thereby eliminating, to some extent, the hammer blow on the rail joints, decreasing the wear on the axle brasses and securing the better alignment of gears; yet, in practice, the nose suspension is still preferred by the writer, as the car starts more smoothly, the weight of motor on spring supports overcoming the jerk and quiver so common in other methods of support. The specifications for railway motors, as drawn up by leading manufacturers of to-day, amount to practically nothing, and I would suggest that the purchaser of motors in his specifications clearly define the rating, heat limit and efficiency.

The series-parallel controller is in most respects a satisfactory device, the chief objection being the narrow range of speed on running notches. Specifications for resistance should provide that the last two points of resistance be of sufficient capacity to allow of their continued use as running notches, especially where cars are operated in city service.

There are several types of magazine fuse boxes or cut-outs and single cut-outs using a special fuse which possess a number of points of merit. Without going into details, it is the opinion of the writer that under average conditions the standard magnetic blow-out fuse box, using a link fuse, is preferable.

Each car should be equipped with a thoroughly reliable lightning arrester. Points to be noted in selecting this device are as follows: The kicking coil should always be installed; the air-gap should be as small as possible; a positive and quick device should interrupt the current after discharge, and not be injured by discharge; there should be a non-inductive resistance in the main circuit which will limit the flow of current and thereby prevent the opening of circuit breaker at the station when several arresters operate at the same time.

One of the most puzzling problems brought before the manager to-day is the amount which should be expended in the maintenance of old equipment before it should be replaced by new. To the average master mechanic this would seem a simple problem of making a careful estimate of the difference in cost of maintenance of the old and new equipment, due consideration being given to the interest on money and its increased efficiency. And yet, after the master mechanic has conclusively shown that by putting in new equipment a marked saving can be made in cost of operation, the manager has to consider the financial condition of the property, the advisability of increasing the investment, the possibility of doing so, and whether there are not other departments of the road where a greater saving can be made by increasing the investment. One should go slow in putting in new equipment, as new apparatus may at first seem to be void of the main defects inherent in old equipment, yet, when put in operation, other defects occur, which, under the varying conditions, may prove even more disastrous than the old.

Maintenance of Equipment

The cost of maintaining equipment depends on various complex conditions, some of which are beyond the control of the manager, and others for which he should be directly responsible. Heavy grades, numerous railway crossings, sharp curves, dirty and unpaved streets, imperfect and poorly constructed equipment, long and severe winters, all affect cost of maintenance unfavorably and are beyond the control of the manager. But the character of the men who operate the cars, the manner of operation, the way in which repairs are made, the character of men engaged in repairs and the material used are the controllable elements and in most instances the chief features affecting cost of maintenance.

Care of Equipment in Car Houses.

Generally one of the following-named methods is used for daily inspection of car equipment: Inspection of cars for each trip, inspection of equipment at night by motor inspectors and inspection of equipment during the day by motor inspectors and repair men.

In regard to the first case, that of the trip inspection, I would say that in the present degree of perfection attained by manufacturers of railway equipment trip inspections should not be necessary, and, excepting on interurban lines operating at high speed over long runs, is of doubtful value. It is expensive, requiring the services of an inspector, who is necessarily a man of some ability, for each line of cars. The period of time for making this inspection is necessarily very short, and the entire time is taken up in mere inspection, little or no opportunity being afforded in which to make repairs.

In regard to night inspection, the experience of the writer has been such as to absolutely condemn this method as expensive, slovenly and unsatisfactory. It is impossible to make a thorough inspection of cars at night, no matter how well lighted the car house may be, and the efficiency of the work done by the men is far below that of the work during the day. Therefore, when local conditions will admit, inspection of cars during the day seems by far more advantageous.

We will assume a car-house station from which 25 or more cars are operated. There is usually one general foreman in charge of this station. His duties are chiefly those of the transportation department, but he should be a man thoroughly conversant with the usual trouble which may occur in the operation of the equipment, and know how to direct minor repairs. It would, of course, be better if he were able to personally superintend the actual work of repairs, but it is usually very difficult to find men who are good mechanics and likewise efficient in the transportation department.

For making inspection and running repairs such as should be made in car houses, it is a safe rule to have one man to seven cars. It is, however, important to have a man in all car stations, known as chief inspector of that division, who is thoroughly conversant with practical electrical and mechanical matters. This chief inspector should have under his care for inspection and repairs seven cars and also have direction and supervision of the other two repair men who care for the remaining 18 cars.

It is important that the responsibility for the proper repair of cars be definitely located, as nothing is so demoralizing to the force of motor inspectors as to have a case of trouble arise and not be able to trace the responsibility at once to the proper source.

The duties of these men should be to make a daily inspection of every car assigned to them, starting first with their motors, examining the grease in the cups, the brushes, cleaning the motors, examining connections, etc. They should remove the covers from their controllers about once in three days and oil the cams very lightly with vaseline or grease, remove any blisters which may have appeared on the contact points and carefully examine the adjustment of contact fingers. Too much emphasis cannot be given to the inspection of all brake rigging, and very thorough inspection should be made daily from the brake-handle to the brake-shoe, and the brakes tried by inspectors before the car is placed in service. A broken brake-chain or worn-out shoe, a broken brake-clutch or a broken brake-pin, are things that should never

FIG 4. ELECTRICAL ILLUMINATION AT THE PEACE JUBILEE.—CLARK STREET AT NIGHT, LOOKING NORTH FROM ADAMS STREET.

occur through neglect, and if an accident of this kind does occur, the cause should be immediately traced and the responsibility located. Economy in maintenance should never be exercised at the expense of absolute safety, and brake-chains, pins and shoes should be discarded long before the danger point is reached.

The general public forms its opinion of maintenance of equipment by the little things on the interior of the car, such as a screw loose in the back, a broken strip on the car floor, a loose register pulley, broken hand-strap, broken glass, rattling glass and hundreds of other little things which make the fittings of a car body. Repair men and inspectors should be so trained that in passing through the car they should note any little thing of this kind at once, and the rule should be that they should stop and repair it at once, for if allowed to wait till some other time the repair is usually neglected entirely.

The actual repair work done by these inspectors should be all work possible to be done without the use of machine tools, or which, if done by them, will not require the loss of the car from service for a period of more than two hours.

If, during this inspection, the motor inspector discovers trouble which is beyond his ability to repair, he should fill out a repair slip and send the car with the slip at once to the repair shop, stating the nature of the required repair, assuming that the repair shop is run as a separate department from that of the car barn. If the nature of the trouble is such as not to immediately incapacitate the car for service, but require the service of the repair shop department, he should fill out the blank as noted and send it to the foreman of the repair shop; but this notice to the repair-shop foreman should in no way release the motor inspector from the responsibility of the successful operation of the car. If the repair-shop foreman is unable, owing to press of work, to take the car off the road at once, it is the duty of the motor inspector to continually watch the development of this trouble, and if at any time he thinks trouble has so developed that the car is not safe for successful operation he should leave the car out of service and notify the repair-shop foreman. If the repair shop is still unable to receive the car at the shop, he should then make a personal examination of the car and assume responsibility for its further operation.

The question as to how often car equipments should be taken to the shops for a general inspection and overhauling, and to what tests the electric equipment should be subjected at the time of inspection, are subjects on which electrical engineers differ widely. Considering the average conditions and assuming that equipment is in good condition, it is the opinion of the writer that the taking of cars to shops once every six months should maintain the equipment in good condition and assure its efficient operation.

Motor Bearings.

Bearings should be run "close" at all times; the the time of their renewal being determined by the effect of the wear on the gear and pinion, as the wear on these parts is largely affected by the wear of the bearings.

After a series of tests covering quite a period of time, as to the wear of various materials used in motor bearings, the writer feels warranted in making the statement that either the best grade of babbitt or brass bearings should, under the ordinary conditions, give a longer life than six months, and when a bronze bearing of the proper mixture is used and properly lubricated a life of 12 months can safely be expected. The method of lubrication largely influences the life of brasses. The writer has, after long tests with various lubricants, discontinued the use of grease entirely on armature brasses, and in most cases on axle brasses, a good

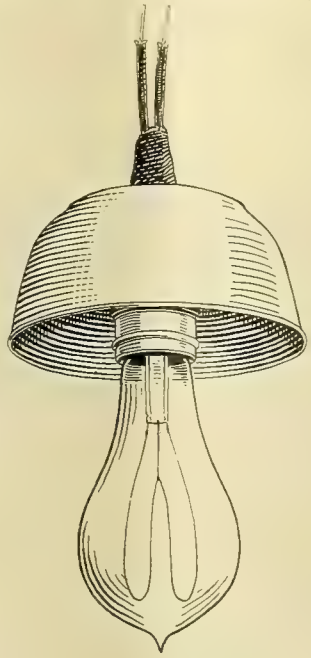

FIG. 5 ELECTRICAL ILLUMINATION AT THE PEACE JUBILEE —RAIN-SHIELD AND REFLECTOR FOR OUT-DOOR LAMPS.

grade of engine oil, supplied through wicks, being more satisfactory and economical.

In order to reduce the maintenance of brasses to a minimum, the use of phosphor bronze is strongly recommended. Street railways operating 25 or more cars will find it economical to cast and machine their own brasses. This may be discouraging to the supply men, but it means money on the right side of the ledger when the expenses are footed up. A small brass furnace can be cheaply erected, and after suitable jigs, which can be attached to any lathe, have been provided for boring and turning, the cost of casting and boring is very little more than the cost of rebabbitting, especially where babbitted brasses are machined after boring, while the life of the bronze bearing is far in excess of that of any babbitt yet tried.

FIG. 6. ELECTRICAL ILLUMINATION AT THE PEACE JUBILEE SIEGEL, COOPER & CO.'S STORE

Rough and burnt commutators are too frequently the cause of expensive motor repairs, and usually indicate imperfect motor design or inexcusable neglect. Well designed motors, in good condition, even under the hardest service, provided, of course, the average work is within the rated capacity of the motor, should not require turning oftener than once in eight months. There is nothing that so well indicates to the practical man the conditions of the motor as the condition of the commutator. Whenever the commutator shows signs of burning or blackening, steps should be taken to prevent it. It is not advisable to try to prevent this by the continual sanding of commutator by motor inspectors, though the occasional cleaning up of the commutator with sandpaper is necessary with all motors. The causes of trouble of this character are so numerous that mention is made of only a few of the more important.

The kind of brush used is an important factor. Brushes should be soft, close-grained carbon, treated with a good lubricating compound which does not flow too freely from the heat from the motor and which will not burn and carbonize on the commutator. The price of the brush is not a material consideration, as a brush which is slightly superior to another will prove economical, even at quite a large increase in first cost. The tension on the brushes is, as a rule, too light on railway motors. It is a common belief that heavy tension causes wear of commutator, but experience has shown that the actual wear on commutator due to friction of the brush is very small, and that increased tension will in some cases materially decrease the sparking, which causes the greatest wear. Improper alignment of brush-holders frequently causes sparking. In recent practice the use of side-contact springs on brushes has been generally abandoned. On motors carrying heavy currents this spring is quite essential, as excessive heating of the brush is caused by limited contact in the holder.

Commutator insulation should be made of what is known as the built-up mica segments of the very softest grade of amber mica. A hard, clear mica should never be used in a commutator, as this mica will not wear away as fast as the copper, and there is nothing so disastrous to the life of the commutator as high mica insulation.

In some motors it may be necessary to change the winding of the armature and field coils in order to avoid the burning of the commutator. First, determine by actual experiment what change in winding is necessary, and then equip with the new winding every armature or field that comes in burned out. This will permit of a change being made without any great expense, as the greatest part will be borne by the maintenance charge.

Electrical Testing of Railway Equipment.

Elaborate systems for the periodical testing of insulation on railway equipment seem to be growing in favor with some electrical engineers, but the practical value of these elaborate tests is not fully demonstrated. Experience has shown that tests of this kind are very misleading, and frequently cause the tearing down of equipment, which, under ordinary conditions, had no tests been made, would have continued in service for a long time.

Judging from my own experience, it is neither necessary nor advisable to periodically test the insulation on the equipment, but to make such tests only in cases where motors are not working properly. The proper training of motor inspectors as to the little points about railway equipment which clearly indicate trouble with the motor will in nearly all cases locate trouble due to weak insulation, so that it can be remedied before any serious damage has resulted to any other part of the equipment.

All armatures and field coils repaired should be carefully tested as to resistance and insulation to ground, and on all armatures having coils repaired, new commutator put on or commutator turned resistance between commutator bars should be very carefully measured, using, preferably, a portable Wheatstone bridge testing set, capable of showing clearly a variation in resistance of .001 of an ohm. This is one of the most important tests to be made in the care of railway equipment, as most burnouts of armatures are caused by the slight short-circuiting of coils, due to solder, acids or copper turnings bridging over insulation between bars under leads, than from any other cause, and which can only be located by a test of this kind. Any mistake in connecting up the leads or a bad joint will at once be detected before any damage has been done. For testing insulation to ground I consider a first-class magneto of 10,000 ohms resistance all that is necessary.

Trucks

The design of trucks varying so widely, very little can be said in a paper of this kind as to detail of maintenance, other than to say that all joints should be kept perfectly tight, and where they do become loose, parts should be swedged out and refitted. All bolts should fit tight, and nuts secured by lock washers. Soft gray iron inset with plugs of soft steel has, in the opinion of the writer, never been equaled for brake-shoes. The material giving the greatest amount of friction against a chilled surface should always be used regardless of cost.

Much has been written of late on the subject of car wheels, their wear and alignment, and still street-railway managers are careless about their wheels. Too much care cannot be given to the sizing and alignment of wheels and the pressure with which they are forced on the axle. The use of sand largely influences the life of wheels, but the conditions vary so widely that I would not be justified in saying that a sand box should in no instance be placed upon a car, but would say where it is possible to operate successfully without them sand boxes should be discarded and other means used for sanding the track. It is in most cases far more economical to fit up a special car, capable of carrying a large amount of sand, and sand the track for, say, 100 feet before each point where a stop is likely to be made, and on grades and in places where the track is ex-

ceptionally slippery, than to sand the rail for its entire length.

Repainting of Cars.

The experience of the writer has clearly demonstrated that it is satisfactory to repaint cars without removing all of the old paint. Patent varnish removers, sealers, etc., are a snare and a delusion. The writer has found the following system of repainting cars to be quite satisfactory: First, remove all old paint by softening it with a blow-pot, just enough to allow it to be scraped off with a broad putty knife, not allowing the flame from the blow-torch at any time to strike the bare wood. Sand surface off well with block and sandpaper. Where any new work has been put in, it should be first

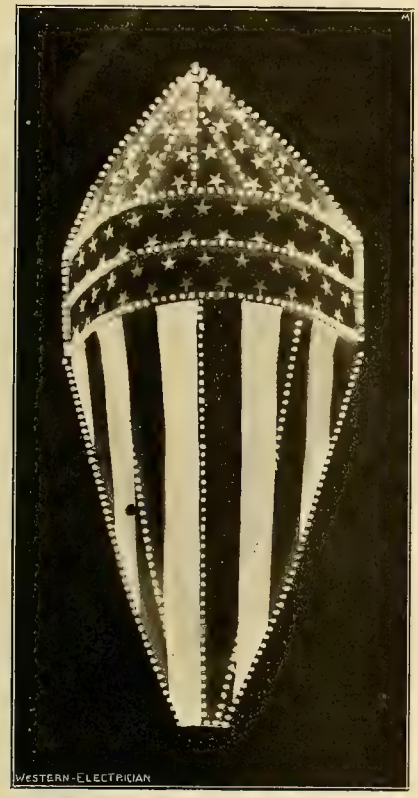

FIG 7. ELECTRICAL ILLUMINATION AT THE PEACE JUBILEE.—LAMP DECORATION ON MANDEL BROS.' CORNER.

primed with a coat of boiled oil and a little lead, and allow it to stand for not less than four days. Dashes and all ironwork should be thoroughly cleaned with strong alkali and primed with a coat of linseed oil, put on boiling hot, and allowed to thoroughly harden, giving one coat of oil and lead before color. If surface is rough, plaster with lead on this coat. Allow it to thoroughly harden and sand with block; then lay on two coats of flat lead, two coats of color, color varnish, stripe and ornament; finish with one coat of rubbing varnish and one coat of finishing varnish. The main object in the painting of cars should be to secure a hard, smooth surface, which will hold out the varnish with the very smallest amount of material; the thinner this surface is the better. Care should always be taken, where plaster is used, to make it as thin as possible, and lead coats, color and varnish should all be carefully tempered, so as to set alike, as most cases of crocking of paint are due to the want of proper tempering of lead and color coats.

A car painted in this manner should not require repainting for from six to seven years if properly cleaned and varnished. Cars should come into the paint-shop, even where the best grades of varnish are used, once every eight or 10 months and be washed thoroughly with pumice and strong soap and given a coat of finishing varnish. The life of varnish depends largely on the care given to the cars in the cleaning department. Cars should be sponged off daily with clear water, and any accumulation of dirt removed as far as possible by the use of a chamois skin and sponge, care being taken to rinse off the grit before rubbing with sponge or chamois. Once every 30 days the car should be thoroughly washed down, using a good grade of soap. If it is impossible to remove dirt and stains from the surface of the cars with the finer grades of soap, strong soap may be used, it being found that the injury to varnish resulting from the use of this soap once every 30 days will be more than offset by the saving in cleaning and touching up when the cars are taken into the paint-shop for revarnishing.

In the selection of designs for painting of cars, the plainest and neatest design should be selected, as a rule. No lettering should be done on the panels, as this increases greatly the cost of maintenance in the paint-shop department. In all cases the signs should be put upon signboards made especially for the purpose.

The inside of the cars should be cleaned thoroughly and rubbed down with pumice stone every second time the car comes into the paint-shop to be revarnished. There are a number of so-called car-cleaners on the market, which are rather a detriment than an advantage to the outside surface of the cars, but which may be used to advantage on the interior of the cars, especially around the sash. Special observation of the interior of cars will show that the varnish commences to disappear first around the sash, moisture from the windows gathering around the molding which holds the window sash, first discoloring it and gradually working into the sash itself. A car-cleaner which is made up largely of oil and dryer, if used about once a week on the window sash and molding, will be found to be a great advantage. Three years ago four new cars were selected and a car-cleaner used weekly on the windows of these cars, and to-day not a stain is to be seen on sash or molding, the cars having been revarnished twice during that time.

After a number of trials of various floor paints and paints mixed especially for the purpose, the concluson has been reached that there is nothing equal to pure white lead and linseed oil and suitable color for the floors of all cars. The majority of car floors are stripped, and it has been found impossible to find any material hard enough to stand on the top of the strips of a car floor, while almost any material will stand the wear, but not the moisture, between the slats. It is therefore very evident that the best paint for this purpose would be one which would best preserve the wood in the floor of the car from the constant moisture to which it is subjected.

As to the car roofs, the main object is to put as little material as possible on the canvas of car roofs, and that material should be elastic and yet withstand the action of the weather. Great care should be used in tempering of paints for roofs. Avoid painting roof one time with one kind of paint and the next time with another, for this will invariably, in the long run, crack and require the renewal of canvas on the roof. In a number of cases it is customary to use slush or any old thing which happens to be in the paint-shop for painting roofs of cars. This is a great mistake, for no paint is too good for the car roof—the best white lead and oil giving the best results.

Unquestionably the truck of the car should be painted with a good grade of lead paint, as it prevents rust, decreases renewal of bolts and adds greatly to the general appearance of the car. A handsomely painted car body, mounted on a dingy, rusty-looking truck, has, to say the least, a half-finished appearance.

Discussion.

Mr. Sloan, Chicago: With us night inspection works quite satisfactorily for several reasons, the main one being that we change our brushes every night. Every motor brush is changed each night. It works well on the commutators and results in very little burning down of the commutators. I have had commutators in for a year with not one eighth inch wear, and I believe it is entirely due to the fact that we change the brushes every night. I think a car cannot be overhauled too often. With us it goes on constantly. When a motor comes in with the armature burnt out, the truck is run from under the car, and another truck already prepared is run in to take its place. In that way we inspect our trucks frequently, and find it works satisfactorily.

Mr. Hawken, Camden, Me.: I am sorry the writer of the paper is not here, as I wish to ask him a question on an important point in regard to the series control of running motors. The electrical people have always advised a certain point for hill-climbing and efficiency of running the motor, and it has been stated that the series point with the fields in shunt has been the most efficient point. I noticed that the rear motor on this point does about all the work, and the forward motor does very little. I know of one company in particular that uses this point very largely, and it has a great deal of trouble burning out armatures. I have made it a point for climbing hills to use the last notch on the series control with the motors connected in series parallel. I find that the most efficient point to run them, and the armatures have a long life.

FIG. 8. ELECTRICAL ILLUMINATION AT THE PEACE JUBILEE.—DECORATIONS ON THE EDISON BUILDING.

A Motocycle Party.

A motocycle party, said to be the first ever given in the United States, was given by Mr. C. E. Woods, 512 East Fifty-third street, Chicago, on Saturday evening last, for Miss Florence E. Woods, his 16-year-old daughter. Seven vehicles took part in the parade, including two cabs, a brake, a trap, a stanhope and two road wagons. The start was made from the Lexington Hotel at seven o'clock, and the trip to the residence of Mr. Woods was by way of Washington Park. After supper at the Woods residence the young people were given a ride and taken to their homes. Mr. Woods is the designing engineer of the Fischer Equipment company.

Power Privileges at Niagara.

The Canadian Niagara Power company has paid to the commissioners of Queen Victoria Niagara Falls Park the amount of the semi-annual rental of the power privileges the company enjoys in Victoria Park at the Falls. The annual rental of the privilege is $25,000, due semi-annually on May 1st and November 1st. On October 18th the power company paid $12,500, which was the amount due on November 1st. This action of the Canadian Niagara Power company is quite important, for it clearly defines the policy of the company in regard to the rights it secured under an agreement made in 1892, and for which it has ever since been paying $25,000 a year. It makes clear the fact that it does not intend to relinquish the plan of developing the power of the falls on the Canadian side, no matter how much the promoters of other companies may wish it to do so.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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Cities cannot say what will be actionable negligence in operating electric cars, according to the recent ruling of the Supreme Court of Illinois, in the case of Rockford City Railway company against Blake. It is, no doubt, true that the city of Rockford had the power, by ordinance, to regulate the speed of street cars within the city, and perhaps other wholesome police regulations might be adopted in regard to the management and running of cars, but the court does not think that the city was clothed with power to determine when, or under what circumstances, a street-car company should be guilty of negligence upon which a recovery of damages might be predicated by a person who may have been injured.

It is gratifying to find complete and unqualified approval of the performance of electric motors in the operation of turret guns from such a high authority upon naval affairs as Captain Charles O'Neil, chief of the Bureau of Ordnance of the United States Navy. The annual report of that officer contains one paragraph that concisely expresses the conditions which make the use of electricity in the management of heavy guns superior to any other form of energy. Speaking of the service during the war with Spain, Captain O'Neil says:

Experience has shown that guns in turrets operated by electric power can be laid upon more accurately and made to follow a moving target than when operated by steam, hydraulic or pneumatic power. There are no water pipes to freeze, no steam pipes to burst, and no delay in obtaining a full working pressure, and no troublesome or noisy exhaust pipes to deal with. A burned-out fuse can be replaced quickly or a broken wire repaired, and as the wires can be led below the armored deck there is little liability of the latter becoming necessary.

These words of praise are well deserved, but they are none the less gratefully received by the advocates of this type of equipment. Captain O'Neil's endorsement should insure the general adoption of electric motors for all work of this kind in the American navy.

A prominent American newspaper writer in London, who possesses unusual facilities for gaining information upon industrial subjects, directs attention to the fact that American manufacturers have supplanted German merchants in competing for English trade. The fear of German competition has subsided, but in its place has appeared a far more dangerous rivalry. Statistics showing the growth of American exports, especially of iron and steel, are seriously commented upon in London, where the success of American bidders in securing large contracts for municipal work and electrical plants is held up as a warning that a keen competitor is in the field. London newspapers attribute much of the success which has attended the introduction of American wares in English and continental markets to the energy of the American consular service in obtaining facts for home manufacturers and opening new markets for exports. The American consuls are described as commercial travelers who are not content with routine work, but are constantly bustling about among English merchants, obtaining samples of goods and supplying the merchants at home with the facts needed for enlarging their foreign trade. The alertness of the American consuls is explained as one reason why England is losing trade, and the practical moral is drawn that the English consular service ought to be reformed on American lines.

This is certainly an unlooked-for compliment to the American consular service. English writers were once in the habit of referring to the American consular system as a striking example of the evils of the spoils theory, by which the public service was converted into a clearing-house for the liquidation of political debts. Our friends across the water are beginning to realize that there are a good many things about the United States, its institutions and its people, that they were long ignorant of. It would be much better for them to investigate the conditions that prevail in this country than to close their eyes to facts. Otherwise there will be a rude awakening in store for them.

Careful attention to details of construction is absolutely necessary for the safe operation of an electrical plant of any kind. Accidental contact between telegraph, telephone, electric-light and electric-railway wires occasionally results in serious damage, sometimes entailing loss of life and not infrequently destruction of valuable property. Danger lurks where least expected, and some of the cases that come under the observation of the electrical inspectors for the fire underwriters prove conclusively that eternal vigilance must be exercised in the construction and operation of electrical apparatus. One of the cases lately reported will serve as an illustration of this point. A misplaced trolley pole from a passing car made contact with a guy wire which was attached to a metal-sheathed electric-light pole. The bottom of the metal sheathing made contact with the glass and iron sidewalk in front of a mercantile establishment, while an old wire cable used for hanging signs completed the connection between the iron sidewalk and the steel girders which supported the building. Half-way across the building one of the girders made contact with a natural-gas pipe. The contact was a poor one and the current, after following the peculiar passage indicated, arced at this point, puncturing the gas-pipe. The flow of gas was instantly ignited and set fire to the floor immediately overhead, resulting in a loss of $2,035. On the other hand it may be said that users of electrical apparatus do not exercise the care that might naturally be expected from those who are vitally interested. Attention is called to the custom of merchants in the smaller cities where a commercial circuit of series-arc lights is operated, of leaving current on wires after closing the premises until the dynamo at the station is shut down. This practice is strongly condemned by the underwriters, who claim that the principal losses due to fires from arc lamps have occurred under such conditions. One of these is noted in the last report. Overheating of mechanism in a 2,000 candle power series-arc lamp, the metal casing of which did not fit, set fire to the ceiling of a store which was closed, although the lamp had been left burning until the circuit was shut off. This fire illustrates the advisability of cutting all current out of buildings when unoccupied. The loss in this case amounted to $3,000.

There have been so many warnings of this kind that it is not to be wondered that the insurance interests sometimes grow impatient. It is the interest of electrical men to observe every precaution that will make the use of electrical apparatus safe and reliable.

Chemists who have attentively followed the published accounts of experiments made in electrical bleaching cannot have failed to note the rapid strides made by electricity in chemical applications generally, although the advance in this particular branch has been somewhat slow and has required much labor and experiment.

In the decomposition of marine salt, by electric currents, without the intervention of a diaphragm, the products obtained, which are chlorine and caustic soda, recombine at once, and form hydrochlorite of soda, the bleaching element. Simultaneously with this reaction, other by-products are developed which are combinations of chlorine and sodium. These secondary reactions are the principal causes of trouble in electrical bleaching.

Carbon electrodes are cheap enough, it is true, but they are rapidly exhausted, and where they are used it is necessary to filter the liquid. Platinum electrodes are durable, but they are very expensive. Dr. Kellner, after long and expensive experiments, has found a solution of the problem, he believes, in what he calls "pointed electrodes," which permit him to produce simply, durably and economically the hypochlorite of soda by electricity. These electrodes are of hard rubber or similar material, with bristles of platinum, like a brush. They are arranged in ebonite boxes, and, under favorable conditions, this apparatus produces solutions containing more than 0.01 of active chlorine—a degree of concentration more than sufficient for most practical uses. The percentage of saturation is dependent, of course, on the concentration of the salt solution, strength of current and temperature.

A solution of hypochloride of soda containing one per cent. of active chlorine under normal conditions of production, with a 10 per cent. solution of sea-salt, contains 2.09 per cent. of hypochlorite of soda, 0.60 per cent. of chlorate of soda and 7.90 per cent. of chloride of sodium not decomposed. The bleaching product is perfectly clear and has an odor resembling that from apples, which it retains for a considerable time on exposure to the air. Like solutions of powdered lime chlorides, it loses this odor by exposure, and experiment has also shown that a solution of hypochloride produced by electrolysis when exposed to light is decomposed less rapidly than lime chlorides.

It must be evident to the chemist that the two solutions will have in general the same bleaching action, provided they contain equal quantities of active chlorine, and experiment confirms this supposition, in the case of wood cellulose, straw pulp, cotton cloth, cotton wool and jute. Bleaching solutions produced by electrolysis, however, have the advantage of making the washing of the pulp easier, besides being less destructive to the tenacity of the fiber. The concentration of the solution is more uniform and the work of bleaching is likewise more uniform.

In addition to the technical advantages mentioned, there are other points of superiority which should not be overlooked. An economy in the cost of production has been shown in favor of electrolytic bleaching solutions. There is marked economy in fact in using hydraulic power, but there is a considerable saving, even with steam, over the use of chloride of lime in powder. Kellner's process has already found favor, and many paper and cellulose mills and textile-fabric establishments are engaged in experimental work along this line of investigation.

President's Portrait in Incandescent Lights at the Omaha Exposition.

During the visit of President McKinley and his party at the Trans-Mississippi and International Exposition at Omaha, Jubilee week, October 10th to 17th, a special illumination of the grounds was arranged with particular reference to the occasion. An elaborate display of fireworks accompanied the electrical exhibition.

The principal feature of the decorative lighting was the illuminated portrait of the president, which surmounted the bandstand in the Midway. It was the central figure also in the display of fireworks and proved the greatest attraction of the occasion. An excellent view of the scene is presented on this page, being a reproduction from a photograph secured by F. A. Rhinehart, the official photographer of the exposition. President McKinley was very much pleased by the display, and those who witnessed the illumination say that the figure was an excellent likeness of the president.

The conception of the plan must be credited to Superintendent Foster of the grounds and buildings, who communicated his wishes to the electricity department. Mr. Rustin assured him of his co-operation, and the services of Mr. Stieringer were at once enlisted. As a result of their efforts they produced an excellent figure, 25 feet high and comprising several hundred small incandescent lamps. The effect was far superior to anything that has yet been produced in this line through the employment of fireworks, although it is said to be the first really successful adaptation of incandescent lighting to this purpose. The effect of the piece can be fully appreciated only by those who witnessed it as the conditions for such a display were exceptionally good. A solid black background brought the lines boldly out, as will be appreciated by a glance at the cut. The inscription under the portrait, "Welcome to our President, our Country and Peace," was also formed of incandescent lamps, and the sentiment was heartily applauded when flashed upon the assembled multitude.

PRESIDENTS'S PORTRAIT IN INCANDESCENT LIGHTS AT THE OMAHA EXPOSITION

Ventilation for London Underground Railways.

[From the New York Sun.]

London, October 15.—The experience of a train-load of 300 passengers stalled in a narrow tunnel many feet below the level of London streets—underneath the river Thames, in fact—has thoroughly alarmed Londoners who had welcomed the completion of a new underground electric railway. There had been a great crowd at the Waterloo station to welcome home the Guards from their campaign in the Soudan. Of course, there was a rush afterward to get to the city, and the new electric line, which plunges beneath the river and up the other side to its outlet in front of the Bank of England, was crowded to its utmost capacity. The electric power proved inadequate to carry an overloaded train up the heavy grade from beneath the river to the city terminus, and the cars stopped. The electric lights grew dim, but there was no uneasiness at first among the entombed passengers.

After a few minutes, however, the air grew heavy. There were no choking odors, of course, such as make travel by the ordinary London underground lines an abomination, but a peculiar sensation of suffocation was soon felt by the closely crowded men and women. It grew worse rapidly. Opening doors and windows did no good, for the iron tube through which the small, low-roofed circular carriages run is but little larger than the cars themselves. It was not long before the passengers became panic-stricken. They left the cars, and making their way with considerable difficuly through the narrow space on each side between the train and the walls of the tunnel, they finally reached the city terminus, about a quarter of a mile distant, on foot.

The theory of deep, underground electric railways, such as are being constructed in several parts of London, and which have been advocated for years by one of the New York rapid-transit factions, is that no ventilation is necessary beyond that automatically provided by the motion of the trains themselves. Experiments have seemed to justify the theory, and no serious difficulty has been encountered when everything has run smoothly. But no provision has been made on the two or three short lines constructed upon this principle for accidents or failure of power, such as occurred on the City and Waterloo line the other day. This line is scarcely a mile long. It dips down from either terminus to its lowest level beneath the river. Gravity carries the trains over two-thirds of the distance each way. Electricity is used for the remaining one-third of the distance. Each track is in a separate tunnel, and the chance of accident on a line so short and so simply constructed is, of course, small. But it exists, and conservative Londoners, not to say the government Board of Trade, will insist that some provision shall be made for supplying air to victims of such a mischance as that above described. The Lancet to-day is not a bit too emphatic when it says:

"It is assumed, and correctly, that the advance of a train through a tube which it closely fits is sufficient to maintain an adequate change of air in the tunnels, in which case no extra provision for ventilation need be made, but in the event of a breakdown the supply of air would soon be exhausted and the result might be disastrous and comparable with the awful historic tragedy of the Black Hole in Calcutta. Either an improved system of keeping up a supply of air must be adopted on the underground electric railways or else a relay of motors must be immediately at hand at both ends of the tunnel to draw the trains out in the event of a breakdown. The former course would be safer, for in the event of a train leaving the rails the delay would be necessarily great and correspondingly serious to the imprisoned passengers. The matter must be referred to the Board of Trade, which we hope in the present instance has not committed a serious oversight. Steps must be taken, if such by some inconceivable want of perspicuity is not already the case, to remove the awful possibility of suffocating a trainload of people. It would be interesting to know whether the underground electric lines in course of construction have included in their plans the provisions of an air supply should any necessity arise."

BOOK TABLE.

Lecture Notes on the Theory of Electrical Measurements. By William A. Anthony (John Wiley & Sons, New York; price, $1.00).

This treatise was prepared for third-year classes of the Cooper Union Night-school of Science, at which the author was professor of physics. It is the purpose of this course of lectures to teach the fundamental principles of all electrical measurements, rather than to describe in detail methods employed in particular cases, and accordingly the definitions and relations of electrical quantities have been discussed in detail, and the derivation of the electrical units has been fully treated. It is the aim to furnish a thorough foundation in the theory of electrical measurements, in order that the student may be better equipped for practical work with a knowledge of typical methods, than he could possibly acquire by the most extended empirical instruction in special methods without such foundation.

Beginning with the C. G. S. units, the course includes the "magnetic field," the fundamental electrical principles and their application to practical work.

American Gas Light Association.

[Special correspondence of the Western Electrician.]

Niagara Falls, N. Y., October 21.—The address delivered before the members of the American Gas Light association at the annual convention at Niagara Falls on October 19th, 20th and 21st by President Crockett of San Francisco contained several allusions of interest to men engaged in the electric, gas and water fields.

"Within the last two or three years," he said, "there has arisen throughout this country a proposition looking toward the acquisition by municipalities of so-called public utilities, such as gas and waterworks, street-car lines, telegraph and telephone companies, in fact, everything that necessitates the use of the public streets. It seems to me that the recent agitation on the subject of municipal ownership of public utilities by the mayors of the various cities should be a lesson to gas managers, showing the necessity on their part of some concerted action to control the theories which are put forth by these men, who have only in a general way studied the subject, and with which they are not absolutely familiar.

"At this particular time and in this particular place, where the greatest long-distance transmission plant in America is in operation, it will not be out of place to say that a great deal of alarm has been felt by some gas companies regarding the transmission to long distances of electricity generated by water power. The experience so far has been that, while in some instances it has worked a hardship on companies operating small plants, the cost of equipping and maintaining an electric plant for long-distance transmission, the high-potential voltage required, the continued loss sustained, the high cost of constructing storage dams to insure a full supply of water during a dry season, have caused this system of lighting to be looked upon with more or less disfavor. This has been practically illustrated this year in California, notably in the city of Sacramento."

He cited the case of the Folsom Water Power company and another company on the South Yuba River, which failed to pay interest on the investment, while the Sacramento Gas company had paid expenses. The electrical people had failed to get a sufficient water supply and were forced to erect auxiliary steam plants. Similar conditions exist in the city of Fresno, he claimed. He added that the introduction of electricity had not proven the great evil anticipated in its commercial form. It had caused, in a way, a demand for the use of much more light than formerly, but above all it had compelled the gas men to find new outlets for the sale of their commodity. Gas as a fuel is now recognized as one of the most economical agents in the world. In San Francisco, where hundreds of thousands of cans are made every year for packing fruits and vegetables, gas is almost the only agent used for fuel in their manufacture, one company alone having asked him to make a bid for 10,000,000 feet per annum for that purpose.

"The question of the utility of acetylene as a commercial product," said he, "has been debated from time to time by members of the gas profession, and while gas men have been disposed to regard it as too dangerous, especially in liquid form, to be used with impunity, still there are others who believe that the product will be materially cheaper in time, and think it can be used with safety and economy.

"One of the most successful ventures of the company which I represent was the buying of gas ranges and loaning them to people free of charge, provided that they use not less than 1,000 feet of gas per month while they had the stoves in their possession. We feared that the stoves would be returned by customers in such bad condition that it would absorb all of the profits to put them in repair again, but, much to our surprise, we found that the stoves came back in good condition."

President Crockett also expressed the belief that when street railroads had their tracks properly guarded there was little or no danger from electrolysis and that fears entertained by many in this direction were practically unfounded. He, however, pointed out dangerous conditions.

New York was selected as the next meeting place, and new officers were elected as follows: President, A. C. Humphreys of New York; vice-presidents, G. G. Ramsdell of Philadelphia, E. G. Pratt of Des Moines and W. R. Beal of New York; secretary-treasurer, A. E. Forstall of Montclair, N. J.; members of council for two years, Rollin Norris of Philadelphia, Malcolm Greenough of Cleveland and C. H. Dunbar of Elgin, Ill.

A telephone line will probably be erected between Perris and San Jacinto, Cal., soon.

DEVELOPMENT OF THE TELEPHONE FIELD.

Intercommunicating Telephone System.

In every large community there is an apparent tendency toward concentration of business enterprises by acquisition or consolidation under one management, resulting in the employment of large forces of men, who are for convenience divided into departments. In many of these there are matters constantly arising which require reference to heads of departments or officials of the corporation. The use of the telephone has been found of great advantage under these conditions, as it is a great time saver and permits every man to remain at his post, although he may be communicating with some distant part of the establishment.

It will be readily understood that these advantages are enjoyed in the fullest measure where a large clerical force is employed, the work of each department having a close relation to that of the others, and where it is necessary to transmit orders, hold conferences and issue instructions. When the People's Gas Light and Coke company of Chicago, which practically controls the entire gas supply of the city, fitted up its new quarters at Michigan avenue and Adams street, it was found that the magnitude of the business required the installation of a complete intercommunicating system. It was found necessary to make provision for a system of nearly 100 instruments to connect the application offices on the main floor, the bookkeepers' department on the second floor and the officials and heads of departments on the third, fourth and fifth floors and also the storerooms in the basement. The entire apparatus was manufactured and installed by the Stromberg-Carlson Telephone Manufacturing company of Chicago.

The plant is interesting because of its extensive character, the particular use which is made of it and the excellent design and workmanship shown throughout. In the accompanying illustrations Fig. 1 is an interior view of one of the application offices, showing six private-plant instruments and three telephones connected with the public exchange. The private-plant instrument is a portable desk set. It is shown more fully in Fig. 2, with a 60-point plug switch. The desk set is very neatly designed and substantially constructed. The plug switch consists of a series of jacks compactly mounted, on

FIG. 2. INTERCOMMUNICATING TELEPHONE SYSTEM DESK SET WITH 60-POINT PLUG SWITCH.

which terminates the direct line from the other instruments of the system.

In this system direct connection can be made between any of the application offices and each desk in the bookkeeping department, which is shown in Fig. 3, without first calling a central office and also between the offices on the other floors. The calling party completes the ringing circuit to the station desired by inserting the plug in a corresponding number of the plug box, regardless of where the plug of the called instrument may be. In this way, should a user neglect to disconnect the instrument or fail to place the plug in the home jack it does not prevent that station from being called by another while so disconnected. The talking circuit is completed by the called party placing the plug in the home number.

The instruments used in this system are of the regular long-distance type, and in cities where independent public exchanges have been established the private system can be connected directly with the public exchange.

The advantages of such a system of intercommunication are appreciated so fully that it is now used not only in many large business houses in the principal cities throughout the United States, but is being installed in many large residences, hotels, public institutions, factories, and of late for connecting mines and mills with offices. The entire system is claimed to have been most carefully worked out in all its details. Objectionable cross-talk is entirely avoided by the peculiar arrangement of circuits adopted. This feature and other valuable points would seem to make it one of the most desirable systems to use where rapid and reliable communication between different departments is required.

Telephony Abroad.

It appears to be the intention of the corporation of Manchester, England, to allow the proposed new telephone company to get its license from the Post-office if it can; otherwise the corporation will apply for a municipal license. At a recent meeting of the Manchester telephone committee a deputation attended from the Mutual Telephone company for the purpose of "endeavoring to gain the committee's support to the application made by the company to the postmaster-general for a license authorizing it to establish and work a telephone system." After hearing the statement made on behalf of the company, the committee intimated that it "would give the matter consideration." In the meantime the committee decided to wait on the postmaster-general in London, and discuss the question with him.

The city of Glasgow applied for a telephone license in 1893, and again last year for a license for the whole

FIG. 1 INTERCOMMUNICATING TELEPHONE SYSTEM.—APPLICATION OFFICE EQUIPPED WITH DESK SETS

Glasgow telephone area. The object in gaining a license was to give the citizens of Glasgow a cheap and efficient telephone service, and also that the corporation might have control of the streets. At a recent meeting of the corporation officials it was announced that the city of Glasgow was not afraid to undertake any improvement, and that it had no fear that at the end of 1911 the system would be so good that the government would be compelled to buy it up. The matter was referred to the parliamentary bills committee to frame a bill to get the power for the license so long sought. It was estimated that the cost of an exchange the same as the present one in Glasgow would at first be only £100,000.

The Newcastle Town Council has opened a discussion on the question of municipal telephones, Glasgow affording the text.

The highways committee of the London County Council has made the following recommendation in an official report: "That the attention of the postmaster-general be called to the expression of opinion in the report of the select committee on telephones, that general, immediate and effective competition by either the Postoffice or the local authority is necessary, and that a really efficient Postoffice service affords the best means for securing such competition; and that he be asked, whether, in view of that expression of opinion, it is his intention to take the necessary measures for establishing an efficient telephone system for the county of London."

The British Columbia Telephones, Limited, was incorporated on October 8th, with a capital of £100,000 in £10 shares, to adopt an agreement with the New Westminster and Burrard Inlet Telephone company, Limited, to acquire telephone lines in British Columbia or elsewhere, and shares in telephone companies, and to carry on business as telephone and telegraph proprietors. The subscribers are English capitalists and manufacturers. The number of directors is not to be less than three nor more than seven.

Telephones in New South Wales are all under the government. The charges are low, and the number of instruments and length of lines are increasing. In 1895 593 miles was constructed at a cost of £6,680, and at the end of 1896 a further construction of 1,772 miles of line had been effected, at a cost of £16,053. The annual telephone revenue increased from £7,212 in 1891 to £31,955 in 1896. During that period 4,084 miles of line were constructed at a cost of over £52,000. There were 5,105 telephones in use in the system, half of that number being in Sydney and suburbs. For the use of public telephones a small charge is made. In Sydney there are only 14 offices of this kind, but there are also telephone stations at 856 telegraph offices in the country districts.

The Paris-Brussels-Berlin telephone line, for which negotiations have just been completed, will have a length of 650 miles.

Colonel Höncke, who was for many years director-general of Danish telegraphs, was born at Flensborg on July 28, 1834, and began his career in the Danish army. He had become captain in the engineers when, in 1877, he was appointed to succeed Herr P. Faber as director-general of telegraphs in Denmark, being the second to fill that office. This position he retained until the summer of 1897, when he was compelled, by ill health, to resign. During his term of office the Danish telegraph system was reorganized and developed, and the present efficiency is due, in no small measure, to Colonel Höncke's efforts. He attended the international telegraph conferences at London, Berlin, Paris and Budapest, and took a great interest in everything connected with telegraphy and telephony. It was during his directorate that the state telephone system of Denmark was started and developed and was also connected with that of other countries.

Extensions and Improvements.

William S. Paca, superintendent of the Union Telephone and Telegraph company of Erie, Pa., visited Chicago last week. Mr. Paca is one of the most experienced telephone men in the independent telephone field. Years ago he started in the employment of the Bell company, worked his way up to a prominent place in that company's service and then entered the electrical supply business in Baltimore. He was successful in this departure, but returned to telephony, this time, however, in the interests of independent telephony. Mr. Paca is examining the telephone apparatus manufactured by Chicago houses, as he expects shortly to return to Erie, from which point he is building several lines to other towns and cities throughout Pennsylvania.

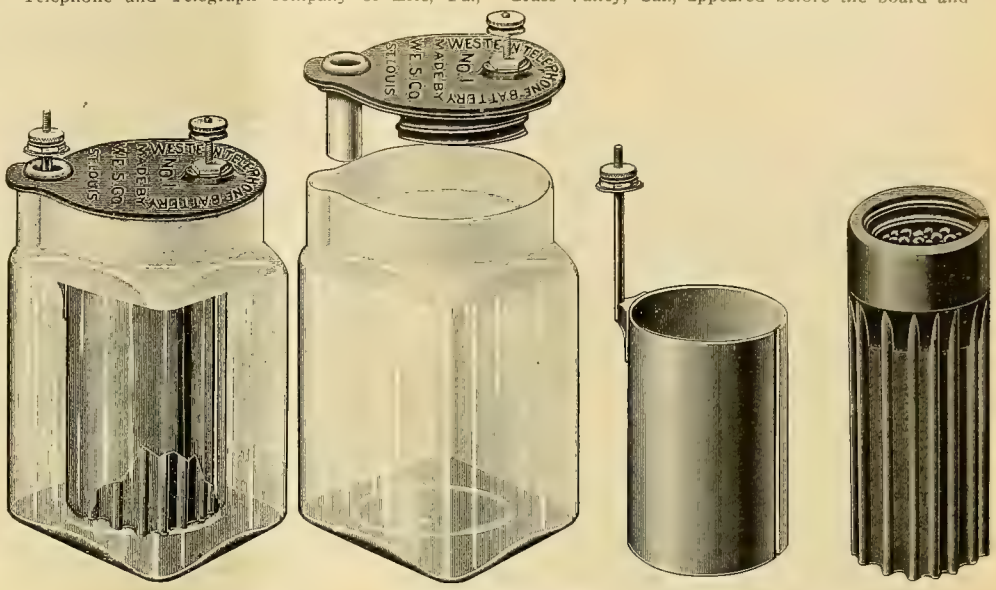
The Sunset company has contracted to build a telephone line from Bangor to Brownsville, via Rackerby.

The Maryland Telephone and Telegraph company has been incorporated by David C. Winebrener, Judge John C. Motter, Wilbur H. Duvall, Hammond Urner and Edgar L. Miller, to operate in Carroll, Howard, Washington, Montgomery, Allegheny and Garrett counties in Maryland, and also in Franklin and Adams counties, Pennsylvania, and London County, Virginia. The capital stock is $30,000.

The Baltimore and Harford County Telephone company, of which Dr. James H. Gorsuch is president, has been granted permission to build a telephone system from Bradshaw, Md., to Rockford.

The question of constructing a telephone line from Chico into the Megalia and Paradise country, Cal., is being agitated.

Chief Engineer Clinch of the fire department of Grass Valley, Cal., appeared before the board and urged that telephones be placed in the various fire houses.



NEW TELEPHONE BATTERY.

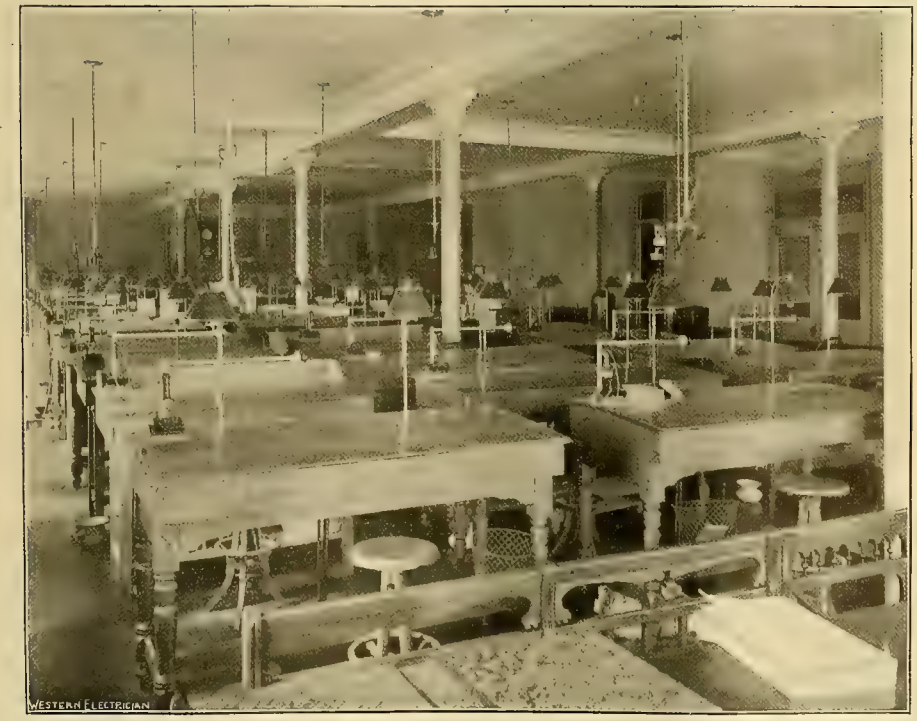


FIG. 3. INTERCOMMUNICATING TELEPHONE SYSTEM.—BOOK-KEEPING DEPARTMENT, EACH DESK EQUIPPED WITH A TELEPHONE SET.

New Telephone Battery.

The battery herewith illustrated has just been brought out by the Western Electrical Supply company of St. Louis and is intended for telephone use. One of the advantages claimed is that the carbon binding-post does not protrude through the carbon, thus allowing a corrosion to gradually ruin the connection, but is screwed in from the top, until perfectly firm, and then made secure by hot solder being poured around it. This makes a connection that cannot possibly corrode, and one that is impossible to work loose.

It will also be noticed that the carbon cylinder is not filled with a granulated carbon and oxide of manganese from the bottom of the carbon and then sealed, but that it is screwed to the cover in such a manner that it may at all times be easily removed and refilled. This, it will be noticed, is a very convenient feature.

The carbon used in this battery is of a selected stock, and no pains have been spared, in making the selection, to procure a carbon that is especially adapted to this class of work.

The workmanship is also worthy of consideration, as the parts are all carefully constructed and put together in a most desirable manner. It will be noticed that the rod which protrudes through the cover is mounted on the cylinder zinc in such a manner that it cannot possibly become loosened, as a shoulder is placed upon the zinc so as to hold it firmly in position.

The zinc cylinder is especially thick, thus adding greatly to its life, and the zinc used is of unusual purity.

The cover of the battery is made of one solid piece of carbon, so thoroughly saturated with paraffine, while still warm from the ovens, that it is absolutely an impossibility for the salts to creep over the top and corrode the connection.

The zinc rod protrudes through this carbon by means of a porcelain tube, which acts as an insulator, and helps to give life to the battery.

The glass jars are not made of the ordinary green glass, but are, on the contrary, made from the purest white flint glass that can be obtained, which makes them not only tough and unlikely to break, but gives the battery a very neat appearance.

Careless Telephone Lineman.

Among the fires reported by the Electrical Bureau of the National Board of Fire Underwriters at 157 La Salle street, Chicago, for the quarter just ended was one due to the carelessness of a telephone lineman. The incident is concisely described in the quarterly report as follows:

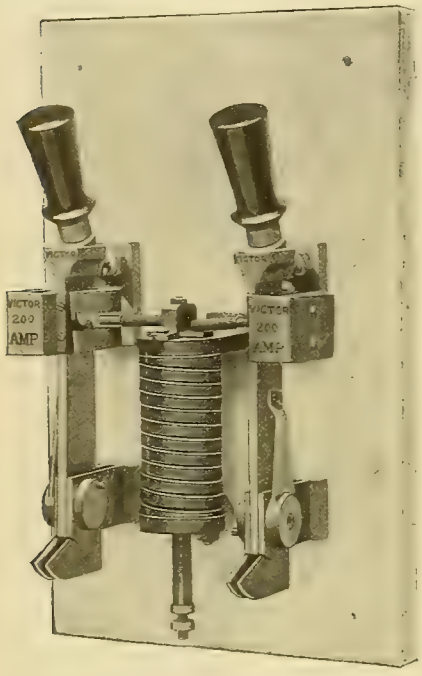
A workman left the loose ends of a telephone circuit lying on a metal roof. About two blocks away the telephone wires crossed over a trolley wire, which made contact when car passed, raising the trolley. The current grounded on the metal roof and waste pipe, setting fire to the roof. The current also followed the waste pipe into the kitchen of the upper apartment, causing a considerable arcing at the sink. The wires were finally cleared from the building and fire extinguished.

A New Circuit Breaker.

The circuit breaker illustrated has been on the market several months and has been used on some of the largest installations in New York city. Many advantages are claimed for this circuit breaker and some novel features are embodied in the construction of the instrument. The action is also different from that of other instruments on the market. This circuit breaker is manufactured by F. A. LaRoche & Co. of New York, who are also the manufacturers of the Ideal circuit breaker and a full line of switches, switchboards and all kinds of automatic switching devices. "Victor" is the trade name of the new circuit breaker.

The style of this circuit breaker is of the fly-out action, but the danger to the operator is reduced to a minimum, owing to the shortness of the blades, and the momentum being checked or broken as soon as the circuit is interrupted. The device has the independent action; that is to say, each blade is separately thrown in and controlled, and in case of a short-circuit or overload both blades simultaneously open. The Victor circuit breaker cannot be closed as long as the overload or short-circuit exists in the line. As soon as one blade is thrown in, and you attempt to throw the opposite blade in, the blade already in the clips will open independently of the blade being closed, thereby making it unnecessary to use knife switches in conjunction with these circuit breakers.

Each blade has a separate latch and catch, which



A NEW CIRCUIT BREAKER.

acts on the roller principle, reducing the friction to a minimum. Each blade is independently hinged on a self-locking hinge post, which, by the act of closing the blade, compresses the clips of the hinge-post, and which can be compressed to any degree, as the locking device is graduated, and is adjustable, and can be set with a pressure of 1,000 pounds to the square inch of pressure between the clips and blades, making them equivalent to a solid mass of copper.

It is stated that these circuit breakers have never been known to heat at the hinge-post with double the amount of current going through for what they are intended. The device is equipped with new-style carbon breaks of liberal capacity, so adjusted that the blades have left the conducting clips one inch before the break taking place on the carbon, therefore preventing burning of the clips, freezing and cutting, which so often causes trouble with switches and circuit breakers.

The solenoid is differentially wound, which concentrates the energy to the center of the solenoid, very little current passing through the outer coil. The coils on the circuit breakers from 100 amperes up are wound with bare copper and carefully insulated, yet when the coil is completed it looks like one solid spiral of copper. The entire circuit breaker is made up of cold hard-drawn copper, no castings being used throughout its entire construction.

The whole conducting part of this circuit breaker is calculated on a basis of 750 amperes to the square-inch sectional area. Each blade has an independent plunger and copper steel spring, which can be removed if required, from the front or back of the board, as may be desired. Another advantage of this circuit breaker is the small number of holes that need be drilled in the switchboard, only seven holes being required to hold the circuit breaker in place and on the board. The range of adjustment is large. A circuit breaker with a normal rating of 200 amperes can be adjusted to break a circuit anywhere between 100 amperes and 400 amperes. The instruments are also made with underload attachment.

Illumination for Department Stores.

The problem of illuminating large retail stores has been carefully and scientifically worked out in the large store of the O'Gorman company at Providence, R. I., and in the Houghton & Dutton store in Boston. In the former store, which is one of the largest in Providence, 124 enclosed electric arc lamps are distributed throughout the different departments, and in the new Houghton & Dutton building 250 of the same lamps are used to illuminate portions of the building now completed.

In selecting the enclosed type of arc lamp, its various advantages over other types were carefully considered, and not until certain practical store tests had resulted favorably was the ultimate decision reached. The results obtained in actual practice have fully borne out the claims of the manufacturers, and in both cases the customers' appreciation is a gratifying testimony to the superiority of the enclosed arc lamp.

FIG. 1. ILLUMINATION FOR DEPARTMENT STORES. O'GORMAN STORE, PROVIDENCE.

The store of the O'Gorman company is in the Alice building, Providence, R. I., where it occupies seven floors and a basement, the fourth floor only being divided up into rooms. The first and second floors are each lighted up by 20 lamps, suspended so as to allow from 10 to 12 feet clear between the lamps and the floor. The third, fourth, fifth sixth and seventh floors and basement are each lighted by 14 lamps, hung at heights from the floor varying with the heights of the ceilings. The average area illuminated by each lamp is almost 600 square feet. The store of the O'Gorman company is the most brilliantly and perfectly lighted in Providence.

The first and second floors of the O'Gorman store are devoted to the sale of general dry goods. The head of this department found the quality of the light excellent from the point of view of illumination and of peculiar value in enabling both salesmen and customers to distinguish easily niceties of shade and texture in the goods. He commented on the absence of all shadows, the quantity of light being amply sufficient to eliminate them, although considerable space is occupied by pillars, cases, cash carriers, etc.

In the two departments on the third floor as much white light as possible is absolutely necessary. Indeed, in no other is a white light more essential than in these, devoted to the sale of the finer class of wall papers and to porcelains and chinawares. In the former the varied patterns and delicate shades of color demand a light which will not falsify them in any way; in the latter, without such a light the finer wares such as Dresden, Wedgwood, Royal Worcester, etc., could hardly be sold on dark days or after sunset. The heads of these departments find the mild, clear, white light from the lamps in every way satisfactory and mentioned the fact that it is particularly easy on the eyes. Although these lamps are burned largely during the day, neither had had trouble with his eyes since the lamps were installed, although with all other forms of light the constant attention to delicacy of pattern and shade of color had seriously affected the eyesight. The fourth and fifth floors are given up to draperies and furniture. Here, too, the ease with which colors, under the enclosed arc, could be selected and such selection not be falsified on exposure to daylight, was considered the valuable feature of the lamp. Customers now rely upon this light fully, whereas in similar cases they could trust their judgment only by taking the goods to the window. A view in the O'Gorman store is shown in Fig. 1.

Fig. 2 shows the lighting of the china and glassware department of Houghton & Dutton, Boston, Mass. In this case double-globe lamps are used instead of the single-globe type, which at the time these were installed had not been fully developed. The excellent results obtained are, however, similar, the intensity of the light alone varying. To the

FIG. 2. ILLUMINATION FOR DEPARTMENT STORES — HOUGHTON & DUTTON STORE, BOSTON.

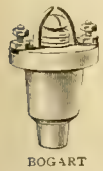
General Electric company Messrs. Houghton & Dutton recently wrote:

"At the time we erected our new building at the corner of Tremont and Deacon streets, the matter of artificial illumination received a great amount of consideration. After thoroughly investigating all the various methods brought to our attention and looking into the apparatus and devices offered, we decided to make use of the enclosed long-burning lamps made by your company. We have already about 250 installed; when our building is finally completed there will be a considerable additional number. The experience which we have derived from the past year's use of these lamps has fully borne out the claims which your representative made for them, and we heartily indorse all your claims for their adaptability to the requirements of large department stores. The light given is the most satisfactory substitute for sunlight in our millinery and fine dress-goods departments that has ever been

brought to our attention. The lamps are very cleanly and reliable in operation, do not scatter carbon dust, are ornamental in appearance and give an evenly diffused light. A great advantage in the use of these lamps in such a store as ours arises from the fact that they only have to be trimmed at long intervals, thereby avoiding the frequent moving of goods with attendant damage, and enabling the trimming to be done out of business hours. The expense of operation is very low, and, taken altogether, we have nothing but words of the highest commendation for this system of lighting."

Bogart Electric Gas-lighting Burner.

The gas-burner shown by the cut is of porcelain, instead of lava and is provided with an improved electrical device for lighting the gas. Lava is regarded by some manufacturers as an unsatisfactory insulator where currents of high potential are employed, such as those produced by the frictional machine or Ruhmkorff coil. To meet this objection the A. L. Bogart company of New York has produced a tip of porcelain.



BOGART ELECTRIC GAS LIGHTING BURNER.

The new form of burner is intended to be used in series electric gas lighting. The base is arranged to fit the metal socket designed to receive and hold the common lava tip of the ordinary pillar burner or of a candle burner. The porcelain used in the improved burner is less liable to breakage either through accidental blows or by the increase of temperature due to the flame. The tip, therefore, is more durable. The high insulation of the porcelain tip permits of the lighting of a greater number of burners in one series. Near the top of the tip are provided grooves in which the electrodes are firmly held in position. This feature of construction preserves the original length of the spark-gap. Another new feature consists of the means of attaching the wires to the electrodes, binding screws being used for this purpose. Thus a firm contact is obtained. The wires can be connected up easily and with dispatch. The nuts of the binding screws cannot be lost, as there is a head at the upper end of the screw. The tip, being white in color, is more attractive than those of the old style, but it may be colored with any desired tint to harmonize with the surroundings.

Pittsburg Transformer.

The cuts illustrate the "type K" transformer made by the Pittsburg Transformer company. Fig. 1 shows the transformers designed for 1,000 and 600 watts respectively, and Fig. 2 the parts and construction of the 1,000-watt instrument. Referring to the cuts, it will be seen that the iron core has the form of a rectangular letter "O," upon the long sides of which are placed the windings. There are two primary and two secondary coils, the primary being wound directly upon the secondary. The transformer is mounted in a cast-iron case, handsomely japanned, and may be operated dry or immersed in oil. The leads are brought out through porcelain bushings, the primary leads at the rear corners and the secondary leads at the front of the case, all issuing perpendicularly downward and well above the oil level.

Alluding to iron and copper losses, the company claims, by the use of the finest grade of sheet steel and by a liberal use of iron and copper, to have reduced the internal losses to the lowest possible amount. The transformers are wound with copper of the largest permissible cross-section, and in the larger sizes thin straps in multiple are used. The advantage of strap over round wire lies in the fact that 25 to 30 per cent. more of the available space is utilized. Flexible strap is wound with greatly reduced risk to the insulation, and by using conductors in parallel the eddy currents become negligible.

It is claimed that the Pittsburg transformers are more liberally proportioned, are heavier for the same capacity, possess lower iron and copper losses, have closer regulation and operate at a lower temperature than any other on the market. At the end of an eight hours' run under full rate load, it is said that the rise in temperature of the oil insulation (which is recommended) will not exceed 40 degrees Centigrade, and, furthemore, at the end of a five-hours' run at 25 per cent. overload the rise in temperature will not exceed 45 degrees Centigrade. It is also asserted that the "type K" transformers will, when operated in oil, safely carry overloads of 25 per cent. for periods up to five hours, with a temperature rise of 45 degrees Centigrade above the air.

All transformers are subjected to a severe factory test and are guaranteed for a year from the date of shipment.

FIG. 1.

PITTSBURG TRANSFORMER.

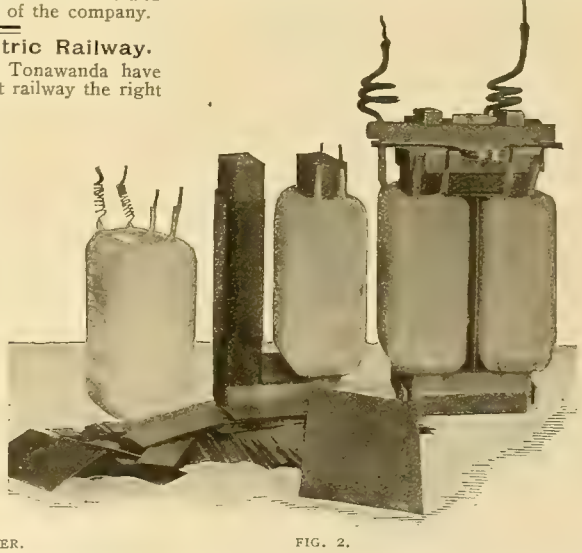


FIG. 2.

Farr Magneto Bells.

The Farr Telephone and Construction Supply company of Chicago, after an experience of more than four years in the telephone business, became convinced that there existed a great demand for a high-grade magneto bell if it could be sold at a reasonable price. With this need in view the Farr company has under construction 50,000 magneto bells of the types herewith illustrated.

Fig. 1 shows the No. 1 bell, which is made with four-inch fields. The magnets are six inches high and nickel-plated. The hook is of the long-lever Bell pattern. The woodwork is of oak and walnut of the highest piano finish. The No. 3 magneto, which is illustrated in Fig. 2, has the same fields as the No. 1 magneto bell. The magnets are strong and durable and are covered with black enamel. The Farr company's catalogue No. 6, recently issued, gives further information relating to these bells and to the other well-known products of the company.

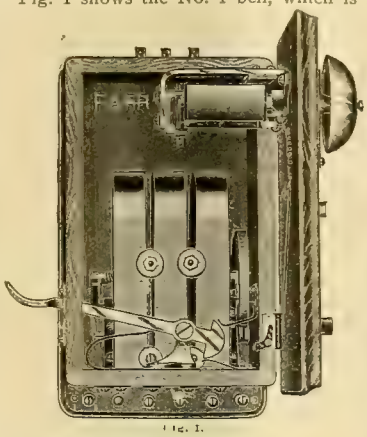


Fig. 1.

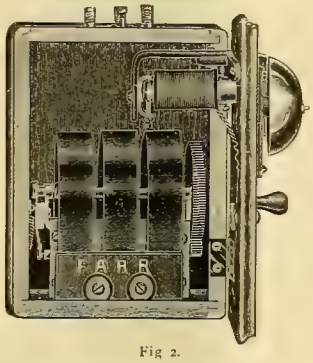


Fig 2.

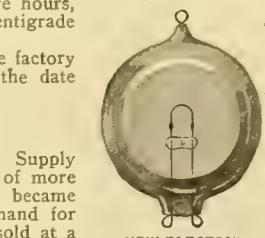
FARR MAGNETO BELLS.

Buffalo-Tonawanda Electric Railway.

The trustees of the village of Tonawanda have granted the Buffalo and Lockport railway the right to lay track connections between their tracks and the tracks of the Buffalo, Kenmore and Tonawanda line in that village. In granting this franchise the trustees incorporated a condition which allows patrons the privilege of going to Buffalo or returning from Buffalo over the Buffalo and Niagara Falls road, or over the Buffalo, Kenmore and Tonawanda line on a ticket bought over either line. The traffic to and from Lockport will pass over the Kenmore line. The new connection will be made along Delaware street.

New Electric Safety Lamp.

There has recently been devised a portable electric safety lamp for use in special cases when an open flame or even one safeguarded as in the miner's lamp would prove dangerous. The combination consists of a dry battery, arranged to be carried in a holder at the belt, or in the pocket. The battery is controlled by a small rheostat, maintaining an even supply of current to the lamp and allowing it to burn with the same brilliancy during the life of the battery. Changing an exhausted for a new battery involves no electrical knowledge. The electric lamp, connected to the battery by a flexible cord, is the miner's lamp manufactured at the Edison Lamp Works of the General Electric company. It is of six candle power, and is set in a small white enameled parabolic reflector, provided with a stickpin to allow it to be attached to the hat or any part of the clothing. The light is strong enough to allow ordinary printed matter to be read at a distance of 100 feet from the lamp. The combination is manufactured by Elmer E. McIntyre of Pittsburg, and has been found very useful by gas inspectors in reading meters in dark cellars; by repair men exploring cellars and trenches for gas leaks and defective pipe connections or examining gaseous sewers; by miners and mine inspectors in gaseous mines, where the risk of explosion even from the miners' lamp is ever present; by watchmen in powder mills and warehouses storing inflammable oils and essences, or by workmen repairing oil and gas tanks or examining the riveting inside steam boilers. This lamp is especially valuable, as it leaves the hands free, and its weight is so small—about two pounds—as to be hardly noticeable.



NEW ELECTRIC SAFETY LAMP.

NEW ELECTRIC SAFETY LAMP.

Power Development at Niagara.

Members of the electrical profession will find the fourteenth annual report of the commissioners of the New York State Reservation at Niagara interesting because of their criticism of the power development at the falls, and also of their expression of opinion as to the needs of Niagara to preserve it from desecration. It is evident that the commissioners noted Lord Kelvin's recent visit to the falls, for they refer to a statement he made in an interview at Niagara. It is plain, too, that the commissioners' hopes as to the future of the falls of Niagara conflict with that of the eminent English scientist, who expressed the wish that he might live to see all the water of Lake Erie reaching the lower level of Lake Ontario through machinery. This would mean the eradication of the grand spectacle now visible at Niagara, which the commissioners, of course, regard with disfavor. They say that the "future of the falls and river becomes a matter of speculation and conjecture," and that the conflict between utility and beauty, between the practical and the ideal, is perpetual. But all that the commissioners have to say on the power question is full of interest, as will be seen by the following abstract:

"In view of the recent developments of power at Niagara by corporations for manufacturing and other purposes, and of the apparent impossibility of preventing further grants to corporations, the future of the falls and river becomes a matter of speculation and conjecture. With reference to this, the remarks of an eminent man of science have been circulating in the public prints as follows:

> The originators of the work so far carried out and now in progress hold concessions for the development of 450 000 horse power from the Niagara River. I do not myself believe that such limit will bind the use of this great natural gift, and I look forward to the time when the whole water from Lake Erie will find its way to the lower level of Lake Ontario through machinery doing more good for the world than that great benefit which we now possess in contemplation of the splendid scene which we have presented before us at the present time by the waterfall of Niagara. I wish I could think it possible that I could live to see this grand development.

"While beauty and grandeur in natural scenery make some impression upon the modern man of science, it is vague and easily erased, in comparison with that produced by utility. The falls of Niagara are no doubt a sublime spectacle, but with the sensations of beauty and awe in the scientific mind there is commingled some more or less conscious disturbance and disapproval in seeing so mighty a mass of water rolling, dashing, foaming along and tumbling over a precipice; and the scientific beholder perhaps involuntarily ejaculates: 'To what purpose is this waste? How much better would it be if the river and falls could be utilized in turning immense turbine wheels and generating electrical power. The falling water accomplishes nothing. It should be operating mills, giving employment to men and women, producing something tangible, useful, marketable! Beauty and sublimity are there, it is true, but beauty and sublimity have no commercial value; they put money into nobody's pocket, unless we except the owners of railroads, hotels and livery stables.'

"Such would seem to be the attitude of not a few scientific and practical men toward Niagara. The conflict between utility and beauty, between the practical and the ideal, is perpetual. Contractors need stone for roads, and the Palisades of the Hudson are shattered by dynamite to supply the material. Lumbermen must have logs, and Adirondack forests go down before the woodman's ax.

"While the attitude of its Legislature toward Niagara has not been consistent, the state of New York has nevertheless done much that is creditable toward protecting and preserving the natural objects of great beauty and celebrity. In addition to rescuing lands adjacent to the falls from private ownership and causing them to be restored to some semblance of their original attractiveness, she has appointed a commission to see to it that steps be taken to prevent further destruction of the Palisades. She has decreed that the devastation of the Adirondack forest lands shall cease, and that vast tracts of those lands shall be placed beneath the ægis of state protection. She has incorporated the Trustees of Scenic and Historic Places and Objects.

"But, we repeat, the state has not maintained a consistent policy with reference to Niagara. After putting an end to private ownership and taking the cataract, the rapids and lands adjacent, under her care and protection, she incontinently grants to corporations the right to withdraw large quantities of water from the upper river, and so to diminish the magnificence of the world's famous spectacle.

"The owners of riparian lands, adjacent to the falls in 1885 claimed compensation for their right of property in the unused water power, but their claims were disallowed. Only a few years afterward the state, by legislative act, granted to corporations, without compensation, the privilege of taking enormous quantities of water from the river.

"In their annual report the commissioners said: 'It is hoped that an international agreement may eventually be entered into between Great Britain and the United States, by which the waters of the upper Niagara shall be permanently exempted from diversion.'

"In view of the probability that an attempt may soon be made to divert large quantities of the upper river into Canadian territory, it seems to the commissioners especially important that measures should promptly be taken to effect the permanent exemption that is so desirable, and by which alone the falls can be surely protected. The withdrawal of sufficiently large quantities of water into Canadian territory and under Canadian authority would undoubtedly give rise to international complications that would require diplomatic treatment.

"Interference with navigation and obstruction to commerce are matters that would probably not present themselves for adjustment. The question is whether the most famous natural phenomenon on the continent is to be diminished in volume, and made less and less attractive to the people of this and other countries, if not eventually destroyed, by private corporations taking and diverting the waters of the upper river for their own use and emolument, with the sanction of provincial or colonial and state governments.

"While it would seem to be a well-settled rule of international law that no right of property can be claimed in the tidewaters of the sea or the running waters of rivers, yet if, to use the language of the late Dr. Travers Twiss, 'the free and common use of a thing of this nature be prejudicial or dangerous to a nation, the care of its own safety will entitle it so far, and so far only, to control the use of it by others, as to secure that no prejudice or danger result to itself from their use of it. A nation may accordingly have a right of empire over things which are nevertheless by nature communis usus, and over which it cannot acquire an absolute right of property; as, for instance, over portions of the high seas, or over rivers which form the boundary of its territory.'

"It was the same spirit which moved the state of New York, in 1885, and the province of Ontario, in 1888, to rescue the picturesque and attractive scenery of the banks and islands of the Niagara from the injury and desecration inflicted upon it in the days of private ownership—scenery, which including, as it does, so grand an exhibition of the forces of nature, so extraordinary a display of natural beauty and sublimity, could no longer by peoples calling themselves civilized, be left exposed to the depredation and defacement that inevitably attend private ownership.

"The questions may well be asked, Has the interest in natural scenery of exceptional grandeur that prompted and approved the establishment of the State Reservation at Niagara and the Queen Victoria Niagara Falls Park wholly disappeared? or has the interest in the development of electrical power and manufacturing enterprises become so general and so dominant as to produce indifference to the future of Niagara Falls, and even tacit approval of plans that cannot but be effective in diminishing the volume of the cataract and defacing it as a world-famous spectacle? At any rate, it must be admitted that the river and falls are at present not safeguarded from diversion and destruction. And the only power that can provide absolutely sure protection is the combined power of the government of the United States and that of Great Britain, known as her majesty's government. In the opinion of the commissioners this protection should be sought, and in their efforts to secure it they invite the support and co-operation of all the people interested in the preservation of the great cataract."

CORRESPONDENCE.

New York Notes.

New York, October 24.—It is supposed that the new $25,000,000 New York Gas and Electric Light, Heat and Power company will operate under one of the numerous old electric-light and power franchises, because no new one can be granted under Greater New York's charter for a longer period than 25 years. The existing New York light and power companies, with the Edison Illuminating company at their head, have extensive plants, with annual revenues aggregating $4,500,000 and a combined capitalization exceeding that of the newly organized company; and it is well known that the Edison company has purchased a block of property upon which it will erect a mammoth electric station to extend its business. It is the guess of some that the new company, counting upon its close relations with city officials, will proceed to install a large plant in opposition to all of the old companies and then precipitate a fight on rates in order to rapidly extend its business and to finally secure control of the whole lighting situation, as was done in Brooklyn. In such a case there is likely to be a lively contest with the Edison company.

The United Electric Light and Power company, the principal competitor of the Edison company, has also announced a reduction in rates, adopting a price of three-fourths cent a lamp-hour as the general basis.

A practice Whitehead torpedo was successfully discharged one day last week from the Holland submarine boat off the foot of Fifty-fifth street, South Brooklyn. The boat afterward made a run down the bay as far as the Crescent Yacht Club, off Bay Ridge. This run was made above water, but on the return trip five successive dives were made. The average depth of each dive was about 20 feet. Soon after the torpedo was discharged the submarine boat got under way. F. T. Cable, the electrical expert of the Holland company, was in charge. This is the first time anyone other than Mr. Holland has handled the boat. The regular crew was aboard, besides the representative of the Japanese navy and Stuart Duncan and Henry Thompson, two local yachtsmen. The boat made seven knots on the trip.

Charles Frohmann got a verdict for $5,000 damages in the Supreme Court in Jersey City on Saturday for being forcibly ejected from one of the Consolidated Traction company's trolley cars. Frohmann and two friends were transferred from a Bayonne car to a Court House car at the junction on March 6th. Forhmann went inside while his friends, who were smoking, remained on the platform. At the Five Corners one of Frohmann's friends was put off the car. Frohmann protested, and he, too, was put off. He alleged that the conductor dragged him off the platform with unnecessary violence, causing a scalp wound and severe internal injuries, from which he suffered for several weeks. The verdict will be appealed.

The State Board of Railroad Commissioners has announced a decision, authorizing the Twenty-eighth and Twenty-ninth street crosstown railway of New York city to change its motive power from horses to the underground system of electricity. M. S.

Northwestern Notations.

Minneapolis, October 24.—Winters, Parsons & Boomers of Butte, Mont., contractors, have sued the Montana Power company and asked the appointment of a receiver and judgment for $48,589.38. The complaint names a number of defendants. The affairs of the company are said to be hopelessly involved. The company proposed to furnish power for electric lights, smelters, street cars, etc., in Butte.

The Des Moines, Northern and Western Railroad company proposes to connect with Valley Junction, Ia., over the tracks of the Des Moines Interurban company's line from Des Moines. The railroad company will switch its cars to the electric company, which will haul them to and from Valley Junction.

The electric-light company of Beloit, Wis., moved its plant recently one Sunday and was unable to turn on its power until late at night. Several churches held their sessions by lamplight as a result.

The electric-light plant at Roseau, Minn., is to resume operations under the management of J. D. Webster and Grant Irish, who have leased the plant.

The council of Tower, Minn., has extended the street-lighting contract with the Electric Light and Power company for 10 years, although the present contract has still two years of life. The mayor refuses to sign the contract. The Electric Light and Power company contemplates building a car line to Soudan at some time, if a favorable franchise is granted.

The street railway company of Helena, Mont., will build a special car for the contractors of the new capitol building, to be used in transporting material over its line to the grounds.

The Des Moines City Railway company was the subject of an item in the Commercial and Financial Chronicle of New York, stating that its net receipts for 1896 were $92,819. This caught the eagle eye of some councilman and a resolution has been passed instructing the city solicitor to look the matter up and see if the city is not entitled to five per cent., as the franchise provides.

Additional machinery has been put in for the electric-light plant at Nevada, Ia. The plant has long been overloaded and an improvement in the service is expected.

J. C. Morrison has put in a new engine for his electric-light plant at Mora, Minn. The rapid increase in patronage has made a larger engine necessary.

William T. Baker of Chicago has refused to accept the electric-light and power franchise passed by the council of Tacoma, Wash. He has been granted a franchise at Seattle, and asked a similar one from Tacoma, but the latter city placed burdensome restrictions in the franchise tendered. He proposes to get power from Snoqualmie Falls.

A trolley car in St. Cloud, Minn., jumped the track at the east approach of the St. Germain street bridge, crushed through the heavy iron railing, and stopped on the very edge of the bluff. A few feet more and the car with the 13 passengers would have gone into the river, down a 90-foot embankment.

The Electric Street Car company of Burlington, Ia., is vestibuling its cars at both ends. It is expected to have the work done by November 1st.

The city of Newton, Ia., has bought the electric-light plant of the New Electric company for $4,000.

The Mason City Electric company of Mason City, Ia., will put in steam-heating mains through the streets and furnish steam heat.

The committee on streets of the Board of Aldermen in St. Paul has passed a resolution forbidding the removal of the poles, wire or tracks of the street-car line on Randolph street. C.

Canadian Intelligence.

Ottawa, October 22.—The City Council of Hull, Que., has decided to ask for bids for lighting the city by arc lights. The bidders will be asked to quote for the whole electric plant, the city to have the right to purchase within five years.

Judgment was given in favor of the Toronto Street Railway company by Chancellor Boyd for $20,326 in the company's suit against the Siemens & Halske company. The claim was for breach of warranty of an electric generator sold to the street-railway company. The action was not defended by the Siemens & Halske company.

The shareholders of the Montmorency Electric Power company of Quebec have ratified the action

of their directors in selling the property of the company to the Quebec, Montmorency and Charlevoix Railway company. The shareholders of the former company not only receive for each $100 share of their stock in that company a share of an equal amount in the latter, but also a 20-year debenture of $100 bearing interest at five per cent. per annum.

The new Metropolitan Electric company of Ottawa has purchased the immense Britannia water power, at Britannia, in the suburbs of this city. The deal was completed last week, and the amount involved is understood to be over $20,000. Mr. J. R. Booth, the millionaire lumberman, owned the water power, the capacity of which is estimated at about 40,000 horse power, and he has given a guarantee to the Metropolitan company that the latter could obtain 1,500 horse power with but an outlay of $6,000.

The anchor-ice trouble in the Ottawa River during the winter months will this season be overcome by the Ottawa Electric Railway company by means of a large storage battery. The company, which uses water power, has heretofore been troubled with anchor ice getting in the wheels at the power house. The power has been greatly lessened as a result, and occasionally the cars have been so short of power that they could not run. The new storage battery will act as an auxiliary and as a regulator. When the power of the machines is lessened or the load upon them is heavy and the voltage is likely to be lessened, the storage battery will come into play to furnish power, and so keep the voltage at a stated point. W.

PERSONAL.

H. H. Brooks of Boston, general manager of the American Circular Loom company, was a Chicago visitor last week.

R. S. Hale and J. S. Codman of Boston have formed a copartnership for the practice of mechanical and electrical engineering.

John McGhie of the General Electric company has an exceedingly interesting article in Cassier's Magazine for November upon "Electric Power in Mining."

George A. Damon will read a paper before the Chicago Electrical association, November 4th, on "The Electrical Equipment of a Model Printing Establishment."

Mr. George O. Nagle, superintendent of the Chicago City Railway company, left for the East on Tuesday evening. He will visit New York and other cities in the interest of the company.

M. Cokeley has been made superintendent of the works of the C. W. Hunt company, Staten Island, N. Y. He has been engaged for several months in revising the factory system. Large concerns are beginning to relieve the office management of the details of the installation of systems and the working out of methods. This work properly belongs to a specialist. Mr. Cokeley has followed this work as a profession for some time, being for many years with the General Electric company and later with other prominent firms. His experience as a practical mechanic has been of great benefit in his line of work, enabling him to detect readily the leaks that invariably exist in large institutions.

A memorial service for John Mason Jackson, the late secretary and treasurer of the Western Electric company, who died in Honolulu, on July 6th, was held on Sunday, October 23d, at the Hyde Park Baptist Church, Chicago, of which he was an active and generous member. His remains, left at the time of his death in a foreign land, now lie under his native flag. The Rev. Dr. J. B. Jackson, his father, was one of the speakers. Others who spoke in eulogy of the deceased were the Rev. J. L. Jackson, pastor of the church; George W. Northrup, Jr., Professor W. C. Wilkinson, Professor E. D. Burton and T. W. Goodspeed of the University of Chicago; E. N. Barton, president of the Western Electric company, and A. D. Wheeler, attorney for the company. C. W. Clark sang two solos.

ELECTRIC LIGHTING.

The plant of the Merrill (Wis.) Railway and Lighting company was destroyed by fire on October 19th. The fire is said to have originated from a spark from an overheated clutch on the main shaft. The plant was valued at $10,000 and insured for $3,000.

Middleport, N. Y., is considering the purchase of an electric-light plant or the making of a contract whereby the village may be lighted. It is understood that a new law makes it possible for the village to have an annual expenditure of a certain amount, and it is thought the lights can be obtained under this limit.

ELECTRIC RAILWAYS.

The Fresno, Cal., Chamber of Commerce has appointed a committee to obtain information bearing upon the feasibility of constructing an electric street-railway system for Fresno.

Superintendent Bishop of the Oakland (Cal.) Transit company states that the company contemplates the erection of a large power house for the system of street railways now under its control, to be located on the water front.

The Lima (N. Y.) and Honeoye Electric Light and Railroad company has executed a mortgage to the Buffalo Loan, Safe and Deposit company for the purpose of securing $40,000, the money to be used in completing and operating the plant. This company owns a trolley line 20 miles long.

The Illinois Traction company has been organized to operate an electric street-car line. The route, as contemplated, is from the terminus of the Chicago City Railway line at Seventy-fifth street and South Chicago avenue to Houston avenue and Ninety-third street, traversing Greenwood avenue from Seventy-fifth street to Seventy-ninth street, then turning east to Anthony avenue, southeast to Jeffery avenue, south to Eighty-seventh street, east to Houston avenue, then south to Ninety-third street. A branch will also connect Commercial avenue and Eighty-seventh street by way of Anthony avenue.

The Buffalo, North Main and Tonawanda street-railway line has been dismantled as far as the limits of the village of Tonawanda. It is the wish of the company to have the rails and ties remain in the paved street, but this is opposed by the trustees of the village.

The annual meeting of the Joliet Street Railway company resulted in the election of the following-named officers: President, Weston F. Milliken; vice-president, George T. Duncan; treasurer, Henry P. Cox; secretary, Henry Wodman, all from Portland, Me.; manager, William B. McKinley, Chicago; superintendent, C. C. Rush, Joliet. The road was found in fine condition, with 25 miles of track, nine laid this year. The capital stock was kept at $500,000.

ELECTRICAL SECURITIES.

The Columbus Street Railway company has declared a dividend of one per cent., payable November 1st.

The Edison Electric Illuminating company of New York reports gross earings for September of $230,-123, an increase of $47,936 as compared with the same month of last year, and net $106,425, an increase of $25,541. For the nine months ended September 30th the gross earnings were $2,170,763, an increase of $427,009 as compared with the corresponding period of last year, and net $908,377, an increase of $142,522.

Judge Spring of Buffalo has handed down his decision in the proceedings brought by the Commercial National Bank of Cleveland, Ohio, holder of $49,000 worth of stock in the Syracuse Rapid Transit Railway company of Syracuse, N. Y., for an injunction restraining the directors of the railway company from paying the extraordinary bonus of $30,000 in cash and $70,000 in capital stock to Edward C. Jones & Co. for negotiating a loan of $200,000 for them. The judge grants the injunction and severely criticizes the directors of the company.

PUBLICATIONS.

The Reliable Electric Manufacturing company, Worcester, Mass., will send its 1898 illustrated catalogue for the asking. This catalogue fully describes the goods the company manufactures, with prices attached.

The late catalogue of the Central Union Brass company of St. Louis describes and illustrates a complete line of electric-railway line material and supplies. Especial attention is paid to the Gem hangers, which are strong and symmetrical.

The Western Electric company has distributed a number of its Bulletin No. 7002, which is descriptive of arc lamps of its manufacture. Any person interested in the operation of an arc-light plant who has not received a copy of this bulletin will be sent one upon request.

The American Circular Loom company is making glad the hearts of its friends by distributing a fine atlas of the outlying possessions of the United States —Alaska, Hawaii, Cuba, Porto Rico and the Philippine Islands. The work also contains a chart of the world, a valuable chronological history of the war between the United States and Spain, descriptions of the newly acquired islands and Alaska, with a number of portraits of celebrities of the war. The maps and letter press are of undoubted value, and the work will be prized by every recipient. The book contains no advertising matter, but on the back cover there are a few lines modestly noting that George W. Patterson is the agent of the American Circular Loom company at 1539 Marquette building, Chicago.

"Friction: What do you know about friction?" Such is the opening sentence of a most interesting little pamphlet that is now being distributed by the Dearborn Drug and Chemical Works, Chicago. This little volume is a dissertation, as the quoted sentence would indicate, on friction. As is well known, the Dearborn Drug and Chemical Works are what might be called "oil chemists," from the fact that the company sells oil on a scientific basis, so to speak. The Dearborn company, as is well known, as the ideal method, too, of treating boilers through the scientific and correct method of chemical analysis. Its oil business is carried on in the same manner, as a glance at the little volume on "Friction" will reveal. This little book ought to be valuable to every buyer of oil who is interested in knowing what he is buying and the true purpose of lubricating oils in general. President W. H. Edgar of the Dearborn works is himself a chemist, and the company's large and lucrative business in compounding of boiler "medicines" and high-grade oils is largely due to his skill in this direction. Secretary and Treasurer Charles M. Eddy reports a most gratifying increase and very bright prospects for the continued enlargement of the company's business. The Dearborn Drug and Chemical Works are awakening to the fact that the business is growing to an extent that will soon necessitate the planting of additional branch houses at other points throughout the United States than those now occupied.

The Billings & Spencer company of Hartford, Conn., has issued a special 112-page catalogue, giving the list of Billings' patent pure lake-copper drop-forged commutator segments for stationary machines. The catalogue in question shows something over 200 different styles and sizes of commutator segments, and the company's idea in publishing it was that it might prove of use to repairers and refillers, also to manufacturers who are designing new machines, who, by using some one of the commutator bars shown in the catalogue, could thus avail themselves of a standard design and obviate the necessity of going to the expense of special dies and tools.

"Improved Brush Arc Lamps" is the title of an artistic brochure just issued by the General Electric company, dealing with the modifications introduced in the latest types of single and double Brush arc lamps, as experience with the operation of old types has dictated. Each detail of improvement is explained clearly and concisely, and thoroughly illustrated, so that even persons unfamiliar with the Brush lamp mechanism will find no difficulty in grasping the import of the changes described. The leading features are summarized, each under its own heading, and the brochure concludes with a full catalogue of the parts not only of the improved lamp, but also of lamps 30 and 31. The pamphlet is issued from the General Electric company's printing office, and in general artistic appearance, letter press and illustrations reflects credit upon that department. It will be sent to those interested on application to any of the company's sales offices.

MISCELLANEOUS.

The Superior Water, Light and Power company of West Superior, Wis., is now figuring on the installation of considerable polyphase apparatus to be used partly for the regular central-station service and partly in connection with the water-supply system. It may also be in the market for considerable three-wire armored cable, should its plans, as now outlined, be carried out.

In the suit of the Marks Enclosed Arc Light company against the Washington Mills company, a decision has just been entered in favor of the complainant. The suit was begun in the United States Circuit Court September 10, 1897, and the decree was granted to the Marks company by Judge Cox on October 18, 1898. The patent infringed is No. 520,996, granted to Marks and Ransom, under date of June 5, 1894, and broadly covers the method of operation of modern enclosed arc lamps. The Washington Mills company used the Kinsman lamp, sold by the Electric Construction and Supply company of New York.

TRADE NEWS.

The Diamond Electric company's works at Peoria were sold to George C. Bailey of Chicago, representing the John A. Roebling's Sons company, under whose claim the factory was recently closed. Mr. Bailey's bid was $7,500 and the claim was $10,000.

The Charles Munson Belting company of Chicago has made an assignment to the Chicago Title and Trust company. The trouble was caused by the failure of A. Groetzinger & Co. of Allegheny, Pa. The assignee is carrying on the business, and it is believed that the embarrassment will be but temporary.

The Appellate Division of the Supreme Court of New York has decided the case of Lawlor against the Magnolia Metal company in favor of the latter. The plaintiff conducted this case on an assignment from men who were formerly the agents for the Magnolia Metal company in London. This suit has been decided in favor of the Magnolia Metal company a number of times in the lower courts. This late decision will probably put an end to the matter and relieve the Magnolia Metal company of any odium which may have attached to it on account of this contention in the past. It is a complete vindication of the company's course in the matter. The Magnolia Metal company now conducts its business direct from New York and London, throughout the entire world, having selling agents at all of the principal points.

Judge Thomas of the United States Circuit Court for the Eastern District of New York has decided three suits brought by Thomas F. Morrin and the Clonbrock Steam Boiler company against Thomas J. Lawler and the Edison Electric Illuminating company of Brooklyn in favor of the plaintiffs in each case. Mr. Morrin and Mr. Lawler were formerly associated in the Clonbrock Steam Boiler company, which manufactures the Climax boiler. There was a disagreement and Mr. Lawler withdrew in 1896, organizing the Columbian Steam Boiler Works. He undertook the manufacture of boilers that were, the judge says, in all essential particulars, duplications of the Climax boiler. The Climax boiler is protected by three patents granted to Mr. Morrin and assigned to the Clonbrock company. One of Mr. Lawler's boilers was accepted by the Brooklyn Edison company, despite a notice that it infringed the Clonbrock patents. The suits were

brought, and the judge has now sustained the validity of the patents in every important particular.

The Bullock Electric Manufacturing company is preparing now to move to its new shops at Norwood, Ohio. The machine shops have been finished for some time and the company could have moved in by this time, if it had not been so rushed with orders that it could not spare the time to build the electrical apparatus needed for its own use in Norwood. The company is building two large generators which are to be direct-connected to a cross-compound engine built by the Lane & Bodley company of Cincinnati. These generators are to furnish power for the machine shop, which is to be driven entirely by electrical power. As soon as these generators are completed the company will move—probably in about two weeks. The process of moving will be done in as short space of time as is possible, as the company has so many orders that it cannot afford to lose time. The Bullock company has lately gotten out a new type of enclosed motor for use in factories and machine shops, for direct connection to cranes, machine tools, etc. The Pacific Coast Borax company ordered 10 of these motors, amounting to 160 horse power, to be used to drive various tools. The Midland Steel company ordered those motors for its traveling cranes, and the Bullock company lately received two more orders for these motors, to be placed directly in the headstocks of lathes.

BUSINESS.

The Session Foundry company of Bristol, Conn., says that its foundry is up-to-date in every department.

The O. C. White company, Worcester, Mass., is showing a line of incandescent-lamp portable fixtures of great variety of design.

The Eureka Electric company of 157 South Canal street, Chicago, issues a sheet of telephones, switchboards and telephone supplies, suitable for hanging up.

The Wallace Barnes company of Bristol, Conn., manufactures small springs of every description and keeps in stock a complete assortment of high-grade cold-rolled steel .003 to .049 inch in thickness.

The Illinois Electric company, Chicago, announces to the trade that it is having a large run on the Edison, Jr., improved incandescent lamps. It has sold thousands of these lamps to the trade this fall, with the best results. Duplicate orders have been received. The company requests a trial order.

The Western Electrical Supply company of St. Louis, Mo., is distributing many complimentary duplicate order books. These books may be had for the asking. They are arranged in a neat and artistic manner and are said to be almost indispensable to station managers if once used. The company has also just distributed its regular monthly "inserts," which method it has adopted to keep its large No. 14 general catalogue constantly up to date. Buyers that have the catalogue and have in any way missed the "inserts" should not fail to notify the Western Electrical Supply company, and the mising sheets will be promptly forwarded.

The name Packard is a synonym for everything that is progressive in the electrical line. It has always been the policy of the Packard company to improve its material whenever opportunity offered. The model 1898 Packard transformer represents its latest improvement in the transformer line. The Packard people claim to have a transformer which is at the very top notch of transformer construction. They have a novel plan of guaranteeing just exactly what each transformer will do. All of their claims, guarantees, etc., are fully set forward in a special circular, which can be had from the Electric Appliance company, Chicago, western agent for the Packard goods.

The Utica Belt-line Railroad company, Utica, N. Y., is erecting on the line of its road a new riveted lattice bridge having a span of about 75 feet. The bridge is known as the Half-way bridge. It is a modern structure in every way for the class of work which it is called upon to do. It is to be all steel except the cross-ties on which the rails rest. The Berlin Iron Bridge company, East Berlin, Conn., has the contract for furnishing and erecting the steel work.

In a recent letter to the Westinghouse Electric and Manufacturing company, Mr. R. G. Vance, Jr., superintendent of the Stevens Coal company, makes the following statements regarding the Baldwin-Westinghouse electric mine locomotive in operation in its mines: "It gives us pleasure to say that this motor is giving the very highest possible satisfaction and is attracting considerable attention in this valley. It has been running since May 1st, and has not cost a dollar in the shape of repairs, excepting a new valve for sand box and a headlight base broken in a collision with a car. It is running on a road of 25-pound steel 4,000 feet long, over undulating grades varying from one to six feet per 100 feet. Its regular load now consists of 20 cars of 1½ tons capacity, and the time required for each round trip is from 17 to 19 minutes. We have pulled as high as 25 of these cars at one trip, which it did with all ease. When necessity requires we can pull 30 cars, giving 50 per cent. more capacity than you guaranteed."

ILLUSTRATED ELECTRICAL PATENT RECORD.

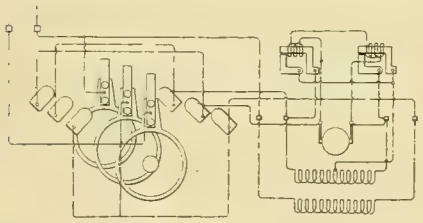
Issued October 18, 1898.

612,410. Electric Trolley Device. Alfred J. Gairing, Johnstown, Pa. Application filed August 3, 1898.

The essential feature is the combination of a single transverse torsion spring secured at each end on the vehicle and a contact-carrying arm having its lower end secured about the central portion of the spring.

612,426. Electric Meter. William D. Marks and George R. Green, Philadelphia, Pa. Application filed January 10, 1898.

In an electric meter there is claimed the combination of a controlling arch, the position of which is determined by an ampere indicator, a pawl-carrying arm or lever cooperating with the arch and effecting the registration, a shaft extending through the arch, a driving-cam carried by the shaft for actuating the pawl-carrying lever and an oscillating motor or pendulum for oscillating the shaft.



NO 612,629.

612,441. Electric Time Alarm. Herbert D. Tenny, Milford, Mich. Application filed February 19, 1898.

A contact device is actuated by the hand at each revolution thereof to close the circuit; a rotatable disk is located upon the outer face of the dial, provided with a series of registering indicating characters thereon and actuated step by step by the hand of each revolution thereof, the dial being provided with a corresponding series of registering indicating characters about the periphery of the disk.

612,457. Electric Railway. Charles H. Myers, Buffalo, N. Y. Application filed August 18, 1897.

In an electric surface railway the combination of a turntable, a hanger attached thereto, an arm pivoted to the hanger and carrying a traveler, and an adjusting lever mounted on the turn-table and operatively connected with the arm.

612,556. Electric Arc Lamp. Charles A. Vigreux and Lucien V. Brillié, Levallois-Perret, France. Application filed March 30, 1898.

Two carbon holders are connected with a brake fly-wheel, and an arm is suspended from the axis of the fly-wheel; a ring surrounds the fly-wheel and is pivoted on the arm; a brake block is formed at the internal circumference of the ring; aspring is applied between the arm and ring for releasing the brake block, and means are provided for electrically rotating the ring to regulate the pressure of the brake block on the fly-wheel and thereby effect the regulation of the electric arc.

612,560. Electric-lamp Socket. John E. Criggal, Newark, N. J. Application filed November 4, 1897.

There is a non-conducting socket base; spiral conducting wires are sealed into the base and form at their outer ends a helical holder, each having at its inner end a threaded spiral eye open at one side and forming a single turn and constituting a binding post for a circuit wire.

612,629. Means for Controlling Operation of Electric Motors. John D. Ihlder, Yonkers, N. Y. Application filed January 26, 1898.

A resistance is included in the circuit of the motor, and a series of electromagnets automatically operated according to the varying potential of the motor armature arranged to control the resistance.

612,644. Depressible-rail System for Electrical Railways. William Grunow, Jr., Bridgeport, Conn. Application filed July 10, 1897.

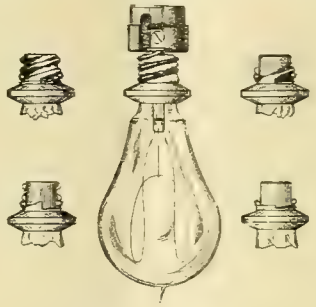
This is a subway consisting of a conduit with beams extending across the conduit, yokes upon the beams provided with curved arms, and slot rails inclosing the yokes and provided with an attaching flange along one edge thereof and having an engaging rjb along the free edge thereof to overlap the extremities of the yoke arms and form a slot.

612,649. Battery Electrode. Herbert S. Lloyd, Philadelphia, Pa. Application filed September 20, 1897.

An electrode comprising a frame of a practically non-active alloy, and thin parallel strips of metallic lead adapted to become in action the active material, and free from interposed paste, the strips being horizontally supported in the frame, electrically connected therewith and having thickened or reinforced outer edges to lengthen the life of the strips in the process of peroxidation.

612,670. Electric-cable Switch. Addison Norman, Toronto, Canada. Application filed April 19, 1897. Renewed June 29, 1898.

An electric cable consists of a supply conductor surrounded by insulating material, portions of which are removed at predetermined intervals, hollow metallic casings surrounding the insulating material and covering the cutaway portions, a freely flowing conducting material within each of the casings, and a working conductor surrounding the insulating material and connected to the casings, whereby when the cable is raised a circuit is closed through the supply conductor, the freely flowing conducting material, the casings and the working conductor.



NO. 612,560.

612,681. Telephone Exchange Mechanism. Harlen P. Snow, Erie, Pa. Application filed November 1, 1897.

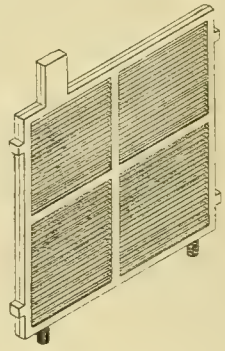
In a telephone exchange mechanism, an office telephone normally out of connection with all the subscribers' telephones, drop mechanism comprising means adapted to be operated by the callers' ring and automatically connect such calling telephone with the operator's office telephone, and mechanism connected with the drops adapted when a drop is pushed back to ring up a telephone called for.

612,696. Rail Joint for Electric Railways. Max Barschall, Berlin, Germany. Application filed March 14, 1898.

In an electric railway track the combination with the rail joint of an auxiliary rail supported by the sleepers and a conductor connecting both jointed track rails and placed in the space between the track rails and the auxiliary rail.

612,702. Automatic Electrically Controlled Railway Switch. Robert V. Cheatham, Louisville, Ky. Application filed March 12, 1898.

In an electrically controlled switch operating mechanism there is the combination with a trolley wire, trolley wheel and a solenoid having its core armature connected with the switch point rail, of parallel contact strips supported at opposite sides of the trolley wire, one of the strips being provided with integral upward-inclined ends and the other composed of a middle section and several upward-inclined end portions, and circuits which are completed by engagement of the trolley wheel with the integral contact strip and middle section of divided contact strip.



NO. 612,649.

612,708. Electric Signaling Apparatus. William E. Decrow, Boston, Mass. Application filed December 27, 1897.

An electric signal transmitter comprising a train, a box number circuit-operating device operated by it to transmit a box-number signal at different speeds at every operation of the train, and an actuating lever for the train.

612,781. Electric Meter or Indicator. William D. Marks, Philadelphia, Pa. Application filed February 7, 1898.

In an ampere indicator there is the combination with the actuating coil or coils of a permanently magnetized movable member and an extra winding or coil on the movable member.

612,782. Coin-actuated Signal Apparatus. Heber R. Mason, Ludington, Mich. Application filed December 31, 1897.

Together with ordinary telephone apparatus, there are employed a cash receptacle, one or more coin-conveying chutes leading thereto, a battery, conductors therefor in normally open circuit, with terminal electrodes disposed along the chute or chutes and arranged for the simultaneous contact of a coin passing through each chute with the opposing terminals of the battery circuit, together with an induction coil included in the circuit and in the secondary telephone.

612,789. Electric Self-loading Street-cleaning Car. Andrew J. Reynolds, Worcester, Mass. Application filed February 2, 1897.

The car is adapted to be run upon tracks in either direction at will, and has a refuse-receiving space at each end, a reversible street-sweeping and car-loading brush, casings for the brush, means for moving refuse toward either end of the car at will, and an independent motor to operate the brush in either direction at will, automatically reversible aprons below the casings, and a reversible deflector above the casings.

Western Electrician.
EVERY SATURDAY.
Vol. XXIII. CHICAGO, NOVEMBER 5, 1898. No. 19

Chicago Types of Electric Carriages.

Before the assembling of the guests for the recent motocycle party given by Mr. C. E. Woods in honor of his daughter Florence, a photograph of the electric vehicles which were to receive the gay party of young people was taken in front of the Calumet Club at Michigan avenue and Twentie.h street. This interesting picture is reproduced herewith. It shows eight vehicles made by the Fischer Equipment company of Chicago, of which Mr. Woods is manager, and there are seven varieties. Beginning at the right of the picture, the farthest vehicle, on Twentieth street, is a mail phaeton; next is a trap, and then follow, in order, around the corner, a brake, two road wagons, a stanhope, a hansom cab and a victoria cab. All are new carriages, especially designed and built for electrical operation. They are handsome specimens of the carriage-builder's art, as well as of the skill of the electrical and mechanical engineer.

Each of the vehicles is supplied with 40 cells of storage battery, and each has two motors supported on the rear axle, one for each rear wheel, except the light road wagons, which have one motor each, with differential gear. One of the road wagons, it will be noticed, has wheels with wire spokes and large pneumatic tires. This was built to order and is not in accordance with Mr. Woods' usual practice, which provides wooden spokes and solid hard-rubber tires. After a number of tests, Mr. Woods concluded that the solid-rubber tires are the more satisfactory. He contends that their use results in a distinct saving of power, when compared with the use of the pneumatic tires, and that they are more durable and much neater in appearance. As far as the superior resiliency of the pneumatic tire is concerned, Mr. Woods thinks that in a properly constructed motocycle the springs make this advantage of little moment.

The motors are wound for about 80 volts and range in rated capacity from 2¼ to 3½ horse power for the vehicles shown. Ordinarily a motor is geared to drive each rear wheel by a rawhide pinion and a gear-wheel on the vehicle wheel. The motors are ironclad. The cells of battery are disposed under the seats and are arranged either for removal from the vehicle, to be replaced by a duplicate, charged set, or for charging while standing in the vehicle.

Mr. Woods' ingenious system for controlling electric vehicles was described in this journal some time ago. It is simple and adapted to the comprehension of the most ordinary intelligence. By its use it is impossible to apply the brake to any of the vehicles without first cutting the power off from the motors and also impossible to apply the power without first liberating the brake. This is due to an interlocking device between the brake and the controller, the operation of both controller and brake being accomplished by one handle. A separate reversing switch is used, by which all of the vehicles are made to operate exactly the same running backward as they do when running forward. It is provided with a lock, so that when the key is removed the vehicle cannot be operated by anyone not possessing the key. The various speeds are obtained by series-paralleling the batteries, and in this work great pains have been taken to insure a uniformity of discharge, from the batteries when in parallel. The contacts and connections have nearly four times the cross-section ordinarily required, so that the resistances may be perfectly uniform.

The vehicles shown in the group vary in weight from the 775 pounds of the road wagons to the 2,700 pounds of the victoria cab. They all have electric side-lights and alarm gongs and are arranged to run at three speed—3½, seven and 14 miles an hour, except in the case of the cabs, where the figures are three, six and 12 miles an hour. The cost of power is given at from three-fourths cent to two cents a vehicle-mile. Three hours is the time required to charge the batteries. The exact data of the types shown, according to the manufacturer's statement, follow:

Mail Phaeton.—Weight complete, 2,400 pounds; average run on one battery charge, 30 miles; total horse power in motors, 6½; diameter of front wheels, 36 inches; diameter of rear wheels, 46 inches; cost of battery maintenance per mile, two cents.

Trap.—Weight complete, 1,800 pounds; average run on one battery charge, 25 miles; total horse power in motors, 4½; diameter of front wheels, 36 inches; diameter of rear wheels, 42 inches; cost of battery maintenance per mile, 1½ cents.

Brake.—Same as trap.

Road Wagon.—Weight complete, 775 pounds; average run on one battery charge, 20 miles; total horse power in motors, 2¼; diameter of front wheels, 32 inches; diameter of rear wheels, 32 inches; cost of battery maintenance per mile, three-fourths cent.

Stanhope.—Weight complete, 1,500 pounds; otherwise, same as trap.

Hansom Cab.—Weight complete, 2,600 pounds; average run on one battery charge, 30 miles; total horse power in motors, 6½; diameter of front wheels, 32 inches; diameter of rear wheels, 38 inches; cost of battery maintenance per mile, two cents.

Victoria Cab.—Weight complete, 2,700 pounds; otherwise, same as hansom cab.

CHICAGO TYPES OF ELECTRIC CARRIAGES.

A Voice from Alaska.

A subscriber to the Western Electrician in Sumdum, Alaska, sends the following: "Your paper comes whenever the mail boat does, and is very pleasant reading."

American Institute of Electrical Engineers.

At the meeting of the Institute in New York on Wednesday, October 26th, a paper was read by A. A. Knudson on "An Electrical Survey in the Borough of Manhattan," and the discussion was opened with a communication from William Maver, Jr., and continued by Townsend Wolcott, Jesse M. Smith and others.

The president announced that a committee on co-operative research had been appointed, in accordance with instructions from council. The committee consists of Dr. A. E. Kennelly, chairman, Professor W. A. Anthony, Dr. F. B. Crocker, Dr. C. T. Hutchinson, Dr. Samuel Sheldon, Charles P. Steinmetz and Professor Elihu Thomson. The purpose is to formulate a system of experimental research, by submitting to colleges and universities problems which are of practical importance. The committee starts off with a list of 16 subjects and will expect members to send in others which may occur to them in the course of their practice. The results, when received, if deemed important, will be published in the transactions. The plan is receiving hearty support.

At the meeting of the executive committee in the afternoon the following-named associate members were elected: John McL. Murphy, New York; F. K. Vreeland, Montclair, N. J.; J. E. Woodbridge, New York. The following-named associate members were transferred to membership: C. H. Wordingham, Manchester, England; William Stanley, Pittsfield, Mass.

Public Lighting in Benton Harbor, Mich.

The St. Joseph and Benton Harbor Electric Railway and Light company has closed a contract with the city of Benton Harbor for 40 arc lights for five years, at $70 each per annum. The Common Council had the subject of municipal ownership fairly discussed at its meeting, and the municipal-ownership advocates were only beaten by two votes on the question of submitting the proposition to the people. On Saturday night, October 23d, Mr. Samuel M. Jones of Toledo delivered a speech in the opera house at Benton Harbor in the interests of municipal ownership. On the following Monday night the council granted to the railway and light company the contract, after Mr. Bean, representing the company, had appeared before the committee of the whole and defined his position in regard to furnishing light to the city. A five-year contract with St. Joseph is held by the same company.

Mr. Bean has been an untiring and intelligent opponent of municipal ownership, and his success at home will be a source of gratification to many whom he has aided in other places.

An Electrical Survey in the Borough of Manhattan.[1]

By A. A. Knudson

The corrosive effect of straying currents upon underground metallic structures is now so well known and understood that obviously there is no need to dwell upon this fact as a reality, but rather it is the purpose of the author to show from actual tests some of the locations and characteristics of the stray currents in New York city.

About 18 months ago the question was raised by some of the municipal officers of this city as to the possibility of electric currents leaking or straying to underground pipes from the conductors of the "open-conduit" electric railway on Lenox avenue, and adjoining streets at that time, as applications had been made to extend this system.

This matter was investigated at that time by the author, and some of the results becoming known to one of the officers of this Institute, he suggested that with some additional tests and the whole presented in a paper, it would prove of interest to the members, and perhaps throw further light on this interesting subject.

I have since made a number of additional tests throughout the city, from Harlem River to the Battery, between various metallic structures, such as elevated-railway pillars, surface railways, water-pipes, etc., and give the results here, trusting that they may prove acceptable, and possibly of some value.

Previous to making any tests on the Lenox avenue line, we had a well-settled theory that in a double-conductor system like this, very little, if any, of the current could be found diverted from the conductors to water or other pipes underground in its vicinity.

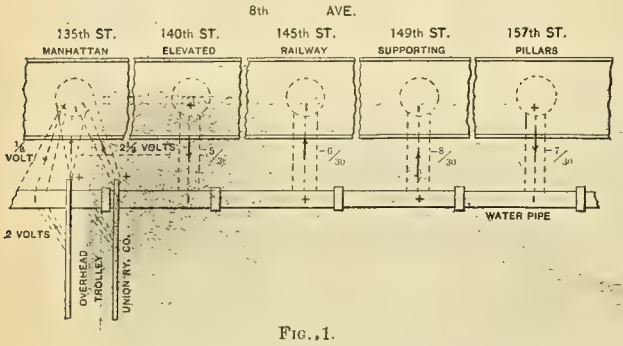


Fig. 1.

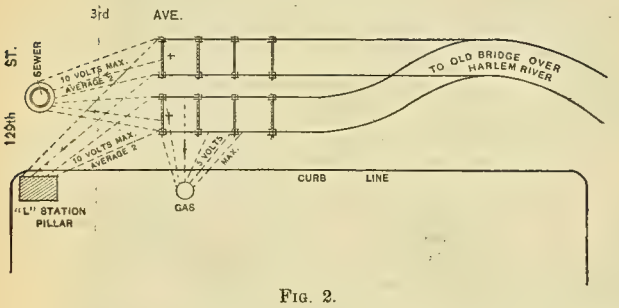


Fig. 2.

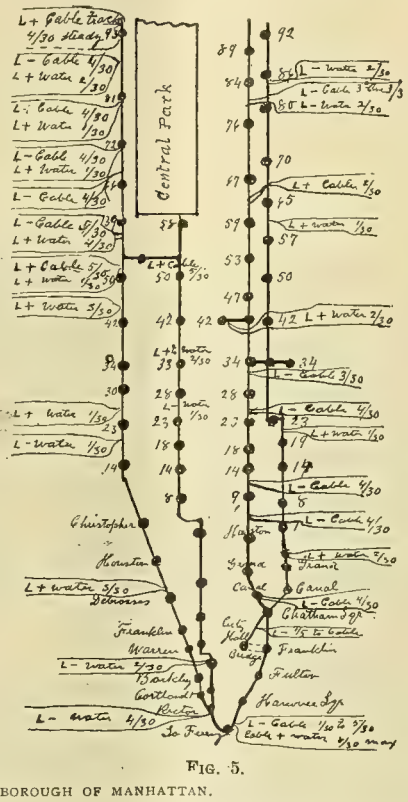


Fig. 5.

AN ELECTRICAL SURVEY IN THE BOROUGH OF MANHATTAN.

The tests were begun on Lenox avenue, near the Metropolitan company's One-hundred-and-forty-sixth street power station, and continued south. From the first, unmistakable signs were encountered of railway-current leakage from the rails of this road to both water and gas-pipes, the sudden fluctuation of the voltmeter needle proving this beyond a doubt. It was noticed, however, that when a Lenox avenue car passed there was no advance of the needle as should be expected, and when two cars passed, going in opposite directions, there was no advance of the needle at the moment; continuing down the street, and testing at each fire hydrant and gas post, the voltage tended to increase upon nearing One-hundred-and-thirty-fifth street. The readings during these tests were as follows, the rails being positive to the water and gas-pipes.

Location	Water.	Gas.
One hundred-and forty-fifth street	1/10 volt	1/4 volt
One hundred-and-thirty-eighth street	2/5 volt	1/2 volt
One-hundred-and-thirty-sixth street	2/3 volt	2/3 volt
One-hundred-and-thirty-fifth street*	1/2 volt	1/2 volt
One-hundred-and-thirty fifth street†	2/3 volt	.....
One-hundred-and-twenty-fifth street	1/2 volt	.....
One-hundred-and-sixteenth street	1/3 volt	.....
One-hundred-and-ninth street and Columbus avenue	1/3 volt	.....

*During this test no trolley car was in sight on One-hundred-and-thirty-fifth street.

†Test repeated when the One-hundred-and-thirty-fifth street overhead trolley car crossed Lenox avenue tracks.

It was apparent from these tests that the most, if not all, of this leakage, came from the Union Railway company's line, operating the overhead trolley system, a branch of this road running through One-hundred-and-thirty-fifth street, and thereby crossing the rails of the Metropolitan company's tracks at Lenox avenue. This seemed the more certain from the fact that the maximum reading (two-thirds volt) was obtained when a Union railway car was crossing the rails at Lenox avenue, or was quite near. Further proof, however, was necessary to determine if that company was responsible for all or only a portion of this current escape; advantage was therefore taken of the period when the Union railway cars stopped running for the night at 1:30 a. m. to make some further tests.

At this time there were no fluctuations of the needle whatever, and consequently no sign of a trolley-current escape from the rails to underground pipes. Tests were made over the same route as during the day, as well as at other places, but although the Lenox avenue line was running (they have an all-night service) no evidence could be obtained of current straying from those conductors to either water or gas-pipes. What we did find, however, worthy of mention, was another current, emanating from an entirely different source, passing from the water pipes to the rails, the pipes this time being positive, which, as will be perceived, was the reverse of the polarity found during the day. This current was as perfectly steady as if from a galvanic battery. The difference of potential, however, was low, in some places one-thirtieth of a volt only was found, while in others the reading was two-thirtieths. In my efforts to identify this current I consulted the manager of the power station which supplied current to the Lenox avenue road, and he obligingly offered to shut down the plant for half an hour during that portion of the night when traffic is the lightest and give me a chance to re-test. This was done between the hours of 2:30 and 3 a. m., when both of these electric roads were then shut down, so that no possible current could come from either one. The same steady current was found, however, as before, passing from the water pipes into the rails. The voltmeter proving insufficient as a means of completely identifying this current, telephone receivers were used, and with one at each ear there was no difficulty in recognizing the familiar sing of the incandescent dynamo. This test with the telephone was repeated several times by my assistant and myself, so that there could be no possibility of error.

It appears from the tests made that an open-conduit system, or one in which an insulated metallic return is used, effectually confines the current to the conductors provided for it. For this reason it is preferable to the ordinary ground return, especially in large cities, where the space below the streets is so largely occupied with lines of iron pipes, more or less subject to electrolytic action.

The distances the overhead trolley current would sometimes reach were shown by a rise in voltage when a Union railway car crossed the tracks of the Lenox avenue road at One-hundred-and-thirty-fifth street. This was found as far down as One-hundred-and-sixteenth street, where the latter road branches east and west; in fact, there was no portion of this road where these trolley-current fluctuations could not be obtained when cars were passing through One-hundred-and-thirty-fifth street.

Desiring to learn the difference of potential between the elevated-railway pillars and water pipes, with the Union railway, if any, in this part of the city, tests were begun at One-hundred-and-fifty-seventh street (Harlem River) on the Eighth avenue line and continued down as far as One-hundred-and-ninth street, which is the western terminus of the Metropolitan company's open-conduit system. Rather than make this paper monotonous with long tables of tests some plans have been prepared of differet locations in the city, showing where these tests were made, and giving the difference of potential at the points indicated. It may be well to state here that the voltmeter used was a Weston two-scale, the lower scale reading to five volts with thirtieth divisions; this scale was used in most of the tests, and accounts for the record being given in a number of cases in thirtieths of a volt. The upper scale read to 150 volts in one-volt divisions.

The following is a general description of the method of procedure, touching in detail at such points as may of interest.

The starting point was at One-hundred-and-fifty-sevent street; from this point down to One-hundred-and-thirty-fifth street the tests are given in a table, as well as in plan, Fig. 1. The table giving both day and night tests for comparison, while the plan gives the day tests only.

The Union railway (overhead trolley), heretofore spoken of as passing through One-hundred-and-thirty-fifth street, terminates at Eighth avenue; in fact, the ends of the two trolley wires of that road are supported by being attached to the "L" structure which, as is well known, passes through that avenue.

Day Test 9 to 10 a m.

Location.	
157th street	"L" + to hydrant 1/10 volt
149th "	"L"— " " 1/10 "
145th "	"L"— " " 1/10 "
140th "	"L" + " " 1/10 "
135th "	Rails U. E. Ry. + to "L" 2¼ volts
135th "	" U. E. Ry + " Hydt. 2 "
135th "	"L" + to hydrant 1/10 volt

Night Test 1:30 to 2:30 a m.

Location.	
157th street	1/10 volt "L" + to hydrant
149th "	" "L" + " "
145th "	" "L" + " "
140th "	" "L" + " "
135th "	" Rails + " "L" Ry.
135th "	" "L" + " hydrant

Night readings steady throughout.

Referring to the table, it will be noticed that the reading at One-hundred-and-fifty-seventh street shows that the night test was the same as during the day. It was afterward discovered that the last car of the Union railway had not then left the track, which acounts for this reading being higher than the other, as well as a trolley variation being shown. All of the other night tests, however, showed the same indications of an incandescent current as were found on Lenox avenue, as well as at several other places. One feature worthy of notice in the day test, shown in the plan, as well as the table, is the change of polarity found at different points on this section of the road.

The current passes into the water pipes and "L" structure from the rails of the trolley road at One-hundred-and-thirty-fifth street (they being positive) from two to 2½ volts maximum, then along the pipes for five blocks to One-hundred-and-fortieth street, then reverses and passes along the "L" structure for another five blocks to One-hundred-and-forty-fifth street, where it again reverses and takes the water pipes to another reversal at One-hundred-and-fifty-seventh street.

The cause of this erratic jumping of the railway current up some pillars and down others may be explained in two or three ways, two of which I will mention:

First—Proximity of water pipes to the "L" structure, at some points being closer than at others, offering a more favorable path for this portion of the current.

Second—The current passing into the water pipes at One-hundred-and-thirty-fifth street as well as the "L" structure at the same polarity, and possibly at a higher voltage at times to water, may cause this change in polarity at different points along the line.

A few days ago tests were made over this same section of road with almost identically the same readings in each case as prevailed over a year ago. It was noticed, however, that the terminal rails of the Union Railway company at One-hundred-and-thirty-fifth street and Eighth avenue had recently been replaced by new ones, which appears to be a good illustration of cause and effect.

Similar conditions also prevail on the section of road below One-hundred-and-thirty-fifth street down to One-hundred-and-ninth street. At this point the open-conduit road has its western terminus. Day tests have shown a maximum reading of one-third of a volt, the rails being positive to "L" pillar, and to water, the night test when Union railway was not running two-thirtieths steady, showing plainly that the current was from that road.

Attention is now directed to the east side of this part of the city, where another branch of the Union railway is located. Tests made there show even more pronounced results than at the branch running through One-hundred-and-thirty-fifth street to the West Side. It may be stated that the power station of this road is located on the Bronx River in Westchester County.

Something more than a year ago, when these tests were made, this branch had a terminus at Third avenue and One-hundred-and-twenty-ninth street, immediately in front of the "L" station, the cars then passing over the Harlem River, at the old wooden bridge, which is now being removed. The cars now pass over the public bridge recently opened to the new terminal at Lexington avenue. Fig. 2 shows the location of the terminal when these

1. Read before the American Institute of Electrical Engineers, New York, October 26, 1898.

tests were made, as well as the difference of potential.

It will be noticed that the maximum reading here was 10 volts, rails positive to "L" pillar, sewer and gas. A test was also made on the Harlem bridge, which showed the same reading, except it was made to gas only, no other pipes being at hand. A few days ago this locality was visited with a view of obtaining any further items which might be of interest for this paper, and workmen were found engaged in removing the rails of this very terminal.

Information was therefore obtained as to the results of electrolytic action on these rails (they having been positive). An impression was taken on paper of the exact size and shape of the end of one of the four rails which composed that terminal switch, the ends of the other rails all being in just about the same condition. Fig. 3 shows a comparison of the size and shape of the rail when new and its present condition, the position of the outlines as to each other being about as shown. From the condition of these rails now, it is quite plain that a large amount of metal has been removed from them by electrolysis. The original size of the rails was furnished by the company supplying the rails, they being 70 pounds to the yard; furthermore, the bottom sides of all these rails were cut by the current down to knife edges for several feet back from the ends. These edges were irregular in shape and somewhat jagged in appearance.

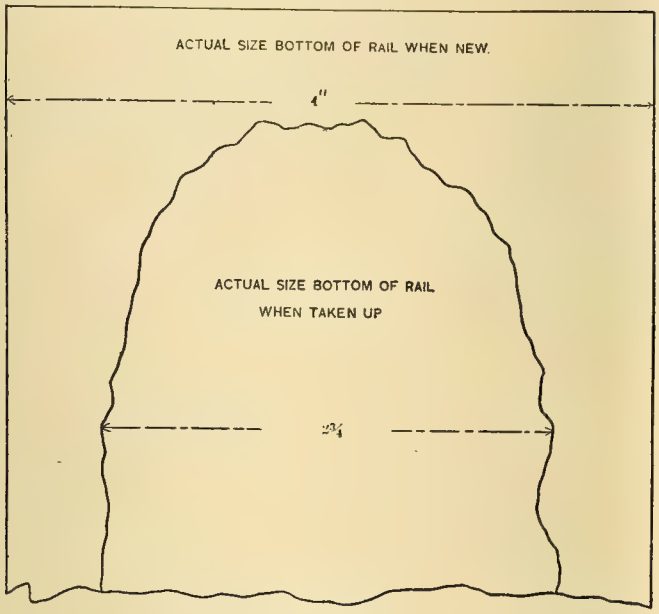


Fig. 3. Plan.

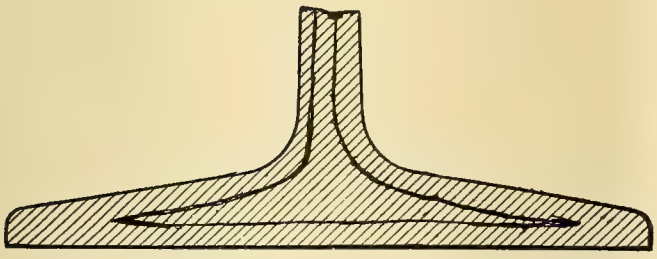


Fig. 3. Section

Another feature of interest is the condition of the cross-bars or tie-rods which keep the rails in position. These bars, which were originally 1½ inches wide by three-eighths inch thick, were nearly all so eaten away that the middle portion was missing, the ends protruding from the rails at from six inches to 12 inches. Fig. 4 gives a view of one of these bars which was conveniently left behind when the other materials were removed. It is the only one I saw which was intact, and is in a much better state of preservation than the others, consequently not an average sample.

This specimen is on the table for inspection by those who care to examine it, as well as some small pieces, broken off by hand, which were protruding from the rails. Your attention is called to a feature not shown in the cut, and that is the sharp knife edge of the side that was deepest in the ground from where the current passed out, somewhat similar in appearance to the sides of the rails referred to; the ridges and pitting characteristics of electrolysis are also plainly visible in this, and in a lesser degree in the smaller specimens.

Further tests were made in this part of the city, but being not specially important are omitted until Ninety-third street is reached, from which point to the Battery a plan (Fig. 5) is given, showing the locations where tests have been made, their voltage and polarity. These tests refer mostly, as you will notice, to the incandescent current, passing at low voltage, ranging from one-thirtieth to one-fifth of a volt. One feature worthy of attention is the lowest reading being generally found at the "L" stations, between pillars under the stations and water pipes. This is accounted for by the fact that as there are water pipes supplied to most if not all the "L" stations, they would make a fairly good electrical connection with the structure itself, and, therefore, not much difference of potential could be expected. This point also suggests a method for remedying this condition of affairs. Coming down the west side of the city, I was surprised to encounter a full-fledged trolley current in the extreme lower part of the city. The first intimation was found at Rector and Greenwich streets. It became more pronounced in the vicinity of South Ferry, where in testing between the rails of the Metropolitan cable road and an "L" pillar, a variation of from one-thirtieth to eight-thirtieths volt was found (the rails positive) and the same reading between the rails and water pipes.

Just why there should be indications of a trolley current in this part of Manhattan Island was difficult to understand; but after making further tests coming up on the East Side, this current was found to come from the Brooklyn bridge. Having pointed out how an overhead trolley, using the water pipes and incidentally the rails as a return, such as is operated on One-hundred-and-thirty-fifth street, can spread its influence, so to speak, for a distance of over 20 blocks in either direction north and south, through various pipes, railway structures, etc., the existence of this current from the bridge permeating underground metals through a large portion of the lower part of the city is accounted for.

The tests were continued at the New York entrance of the bridge, and at the pillars which stand in the street just west of the Third avenue cable railway I found the readings as follows: At one pillar a maximum of three volts, average 1½ volts, pillar positive to Third avenue cable rails. At another practically the same reading. Further up Park Row, at the corner of Chambers street, pillar positive to cable rails, one volt maximum; water positive to cable rails one-half volt; pillar positive to water one-third of a volt.

All of these tests were made nearly a year and a half ago. A few days ago, tests were made over this same ground, and at places where a difference of potential of three volts maximum existed at that time, it is now found to be 3 1-5 volts, pillars positive as before to rails of Third avenue cable and also to water pipes, showing, in all probability, that this current has been during all this time actively and unceasingly passing down the pillars which support the "L" station at this place, as well as the bridge crossing the street, and out from their foundations to other metals, with now a fifth of a volt more for good measure.

In the light of present knowledge on this subject the very serious question presents itself to any practical mind: In what condition would we expect to find the anchor bolts and iron foundations of these pillars, if excavations were made at their base?

Fig. 4.

AN ELECTRICAL SURVEY IN THE BOROUGH OF MANHATTAN.

In Mr. Farnham's excellent paper read before this Institute four years ago, he showed that but a small fraction of a volt was necessary to establish electrolytic action between metals.

What, then, can be expected from an incessant action of from 1½ to 3 1-5 volts jumping out of these foundations during the last year and a half or perhaps two years?

Further tests at the New York entrance of the bridge, at pillars nearest the four loop tracks, show that they are negative to rails of these tracks with maximum voltage of 3¼, an estimated average of 2¼. The tests were made on three different days at different times of the day, the highest maximum reading being taken at 4:45 p. m.

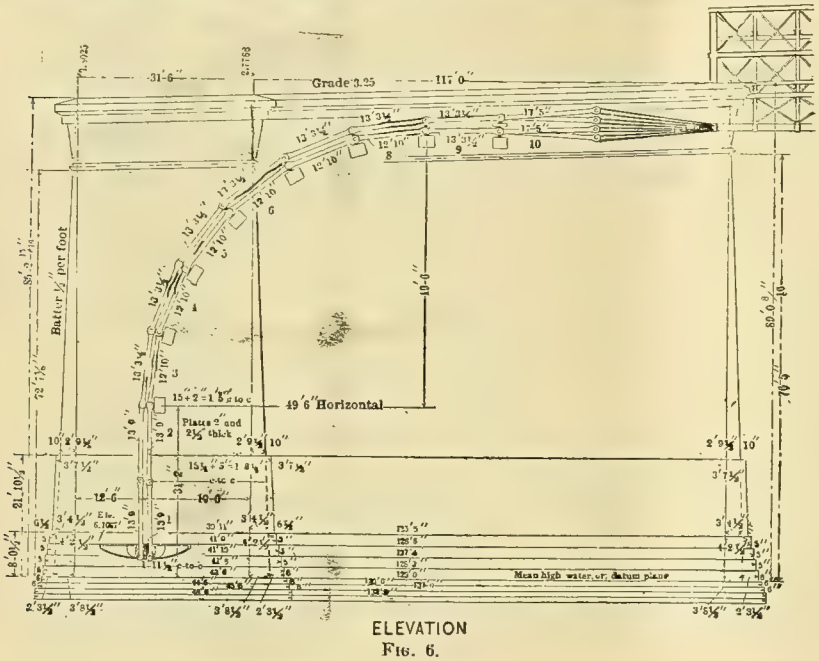
The other tests, one made during the so-called rush hour, between 5:30 and 6 p. m., where a maximum reading of 2 1-5 volts was noted at track 1, did not vary much from the tests made in the afternoon of another day at from 2 to 2:30 p. m. at track 4, where the voltage was found to be 2⅛ maximum. Previous to any use of electricity for operating cars on the bridge it had been known that currents were escaping to that structure from trolley lines in Brooklyn, and, passing over, would find their way through the city, by underground pipes, etc., and, thence across the river again, return to the power station in Kent avenue.

The polarity of both of these railway systems now operated on the bridge indicates that these currents escape from their lines, but it is also quite likely that currents are even now coming over the

bridge as they were a year ago. Only an extended investigation would determine these points, even if it were desirable that they should be known.

Let us now take up the investigation made on the bridge to determine, if possible, the movements of straying trolley currents and their possible effect on the cable terminals. In view of the importance of this matter I regret not being able to make it more thorough than here stated, as it would involve not only a fortnight's work at least, but the shutting down of the bridge plant for a time, which could hardly be expected under the circumstances. Such facts are represented, however, as it was practicable to obtain. Recognizing the necessity of having every detail as to the construction, location, etc., of these terminals before being able to intelligently consider the matter, plans prepared by the bridge engineers were obtained, which are given in Figs. 6 and 7. These show the exact construction of the cable terminals and anchor plates, besides other information regarding construction, all of which is from an official source.

In regard to the construction of the cable terminals: as most of us know, the main cables are made up of 18 strands, or smaller cables, which are practically continuous, the wire running back and forth from New York to Brooklyn, passing through the holes at the ends of heavy steel bars or links at each place, and the ends of the single wire being finally fastened by a rigid screw coupling. These two rows of steel bars of nine each, which are attached to the cable strands, one row placed over the other, as shown in Fig. 6, pass down with a graceful curve into solid stone masonry to the anchor-plates, and are secured to them by heavy steel bolts passing through the eyes at the ends, as shown in the figure. The anchor-plates are in shape somewhat longer one way than the other, each being a single piece of cast-iron weighing 23 tons.



ELEVATION

FIG. 6.

AN ELECTRICAL SURVEY IN THE BOROUGH OF MANHATTAN.

Coming now to the tests, it will be noticed that there is no possibility of reaching the anchor-plates other than by connection through the cables themselves, and they, being firmly attached to the structure, cables and all are practically one conductor, and a connection on the structure would mean connection with the cables, and consequently with the anchor-plates.

This point therefore being settled, the next thing was to obtain a suitable ground; and, on the suggestion of Mr. C. B. Martin, the electrician of the bridge, one of the railway cables was used during that portion of the day when it was not in operation for hauling a bridge train. This was a convenient as well as a good ground; the cable surface, being polished bright through friction in passing over the pulleys, it was possible to obtain a good contact, and as it passed over the large drums in the engine room which were on foundations connecting with engines, water pipes, etc., it was probably the best ground independent of the structure obtainable. The connection to the structure was made by the use of a two-inch screw-clamp, the wire to the voltmeter being attached to it by the simple means of a screw and washer. Two of these clamps were generally used in nearly all of the previous tests, as they were found very convenient for attaching and detaching quickly to and from hydrants, pillars, etc. The first test under these conditions was made just over the Brooklyn anchorage, where the structure was found to be positive to the ground, with a difference of potential of 2¾ volts maximum, estimated average 1¾ volts.

At the Brooklyn tower another ground connection was made to a water pipe, which ran down the side of the tower, and is intended for use in case of fire on the bridge. At this point the reading was 3¾ volts maximum, average 2¾, bridge structure was, as before, positive. At center of span, structure positive at first, readings showed 2¼ volts maximum, but during the readings there were two reversals, one of them only remaining long enough to obtain a reading, which was 1¼ volts maximum, structure negative. At the New York tower, structure positive to cable ground, with trolley variations ranging from three-fourths to three volts, the average was two volts. At New York anchorage, maximum 2¾ volts, the average was two volts; structure positive to ground.

Other tests were made to determine the polarity of the rails of the bridge trains, and they were found positive to the structure, the same as the rails of the trolley road heretofore tested.

Let us now consider the question of the electrolytical conditions of the cable anchorages, as this point appears to be of high importance in this matter, if not the key to the whole situation, in determining whether or not electrolytic action is going on.

First—These anchorages are composed of solid stone masonry, and are put together with the highest quality of cement; there is no brickwork or mortar in their construction.

Second—The 23 tons of iron composing the plates are set about 80 feet below the top of the anchorage. The distance from the bottom of the plates to mean high water is three feet eight inches at the New York end and five feet at the Brooklyn end; there is no earthy matter, salts or alkalies, such as is found prevalent in the streets, which go to make up an electrolyte, so I am informed, in any part of this structure.

I was at first apprehensive that on account of the comparatively short distance between mean high water and the plates at both anchorages there might be opportunity for salt water to reach the plates through seepage or capillary attraction, and thereby produce such an electrolyte as to cause corrosion, but have been informed that it is not possible for salt water to reach these terminal plates on account of the distance from the river, the anchorages being over 900 feet from the towers, which stand at each side of the river. Even allowing 100 feet for the salt water to work back, there is still ample margin as to distance before salt water can reach these plates; besides this, one of the bridge engineers showed me a plan of the construction of the foundation under each anchorage, which consists of heavy timbers 10 inches by 10 inches, and some 12 inches by 12 inches, arranged in four to seven layers, placed a short distance apart, and the intervening spaces filled in with concrete cement.

In view of the tests therefore that have been made showing the structure and cables to be positive at both ends, it is quite possible that a portion of the currents straying from the trolley lines, and possibly from the bridge service, find their way out of the anchor-plates through the dampness of the stonework of these anchorages. The construction of these anchorages, however, is such that it seems reasonable from the general construction of these piers that the mass of stone and concrete surrounding these plates will not constitute an electrolyte such as would favor electrolysis, and thereby cause corrosive action on them.

One of the bridge officials informed me that a certain authority had reported that electrolysis would not attack cast-iron, consequently their cast-iron anchor-plates were exempt from such danger. In the light of recent experience in other cities, that theory is now untenable; for instance, I will quote a few extracts from a pamphlet, giving the reports of four experts, besides that of the secretary of the Water Board of the city of Dayton, Ohio, embodying an estimate of cost for repairing the damage:

Mr. E. E. Brownell, C. E., states: "To my surprise I have found in this city a six-inch water main that was corroded to the depth of one-quarter of an inch where the voltage did not average over 1.5 to two volts positive to the rails, therefore it is impossible to establish a certain voltage that will cover all cases for low readings."

The following extracts are quoted from the report of Mr. J. H. Shaffer, metallurgist, made in accordance with instructions from the board, after a careful inspection of the cast-iron water mains at different locations in the city:

This excavation was made at the corner of Washington and Mound streets. It exposed a six-inch main and a 10 inch tee; the pipe was laid in 1874, and the tee in 1888, both were subjected to electrolytic action for about ten years. Both pipe and tee showed great evidence of electrolytic corrosion, the pipe being damaged to an alarming degree, with holes pitted from one-eighth to five-sixteenths of an inch in depth, and covering a large portion of the same. * * * The lead caulking was found to be in bad condition, and showed perceptible evidence of leaking. The pipes at this point were nine volts positive to the rails.

This excavation was made on Germantown street, near Krug. It uncovered a six-inch pipe. This pipe was electrolytically corroded in about the same proportion, with other conditions identical. A lead service pipe was also exposed at this point and was found to be entirely destroyed.

A quotation from the report of the secretary on an approximate estimate of the cost of replacing water pipes damaged by electrolysis caused by electric-railway currents may also be interesting:

In calculating the cost of replacing the pipes in the whole affected territory, it is estimated at $77,208.80.

There is 17,513 feet of pipe that shows a voltage of from two to nine volts positive, and from pieces of pipe removed where electrically charged to this extent, it is found that they have deteriorated 50 per cent. in four years.

Where they were required, when laid, to withstand a hydrostatic pressure of over 300 pounds per square inch, when tested by J. H. Shaffer, iron expert, after being subjected to 4.5 volts for four years, leaked at 150 pounds pressure.

At 4.5 volts it has been shown that a six-inch pipe can certainly become useless in five years.

I have quoted thus freely from this pamphlet for two reasons, one to show that it is a mistake to suppose that cast-iron is not subject to corrosion by electrolysis produced by railway currents, and also to show the penalty to which a city is subjected through permitting such conditions to exist so long that they cause such heavy damages to its property. In the light, therefore, of what has been shown to be the state of affairs in the upper part of this city due to escaping railway currents, as well as the experience at Dayton, O., it appears to be the duty of engineers to exercise every possible precaution against the effects of this invisible element of destruction, which, if left to itself, will certainly shorten the life of valuable city property.

In the cases found to exist uptown it is true that the rails of the road referred to are apparently the principal metals damaged, for the reason that they happen to be positive to the water pipes, but as the escaping current goes into the pipes at one place it must come out at others, and at these places damage may be looked for.

The damage already done and threatened to public works in England by electrolysis has led to the establishment of regulations to prevent such action in the future, and similar legislation may be expected in this country should these conditions be allowed to continue. One of the provisions in the regulations prescribed by the British Board of Trade may be of interest just here. It is to the effect that if the pipe is negative to the rails the potential difference shall not exceed 4.5 volts, and if the pipe is positive to the rails the potential difference shall not exceed 1.5 volts. This appears to be very liberal for the railways, in view of the experience in cities on this side of the water; it is probable, however, they will be made more stringent as future experience in this direction dictates.

I have purposely avoided elaborating any particular scheme for preventing damage by stray railway currents in this paper, for the reason that methods are perfectly well known to railway companies for confining currents to their proper conductors, such as efficient bonding, and providing a return that will leave no inducement for the current to seek underground pipes, in preference to a legitimate conductor. It is simply a question of additional expense. Referring to the incandescent-light current which was found prevailing everywhere in this part of the city from the Harlem River to the Battery, passing between all kinds of underground metals, and some on the surface, I do not consider these currents as particularly dangerous at the moment, on account of their low voltage, but, as before stated, it having been established that a fraction of a volt difference of potential will cause electrolytic action, it then comes down simply to a question of time when those straying incandescent currents will have to be seriously considered.

In conclusion, I wish to say that these remarks regarding possible damage to public structures, through the action of electrolysis, have been made with no desire on my part to appear as an alarmist, but to present simple facts as found in these investigations. I believe that too little attention has heretofore been paid to this matter by any of us; perhaps for the reason that, electrolytic action being invisible, as well as noiseless, it has thus escaped attention, and its baneful effects not fully appreciated. It is my opinion, however, that ordinary caution would suggest, that periodical tests should be made in every city by competent parties where a trolley road using a ground return is in operation, and the reports placed before those having authority

to deal with the matter. In this way threatened damage by electrolysis to water and other pipes, as well as bridges, might be arrested and finally controlled.

The Horseless Carriage in France.

While to the United States must be awarded the medal for advancement in many of the practical applications of electricity, France is certainly entitled to distinction for the utilization of electric power for the propulsion of carriages. The conditions in Paris are particularly favorable for this method of transportation. The Parisian is a man of pleasure, the capital is a city famed for its gaiety, its round of entertainments, its fuss and feathers, and anything which will add to the enjoyment of the people there assembled will always find favor. A homeless community, as Americans regard home, where the people sleep in apartments, eat at restaurants and spend their evenings largely on the streets and in the parks and gardens, or at some place of amusement, it is not to be wondered that the horseless carriage was welcomed.

Nothing pleases the Parisian better than to go somewhere, and to go always—a natural result of having no fireside circle to attract him. How to go easiest and cheapest—for the Frenchman is a strict economist, despite his gay, pleasure-seeking disposition—is ever uppermost in his mind, and one who has seen the miserable Parisian turnouts which are at the disposal of the public—cheap and nasty—must sympathize with any idea which tends toward a betterment of public-carriage service.

France is in the front rank in electric automobile transportation. Petroleum, gas and electricity are the contestants, and the struggle has been fierce, but electricity made the most favorable showing in this year's meeting at Paris, where many forms of vehicles participated, including coupés, victorias, vis-a-vis, landaulets, milords, drojskys, cabs and one phaeton from London. Originally 26 vehicles were entered for the contest, but 12 only put in appearance the first day, and one petroleum machine reported for the trials. The carriages, with their passengers, weighed from 1,180 kilogrammes to 2,700 kilogrammes, the petroleum coupé weighing 1,370 kilogrammes.

Three itineraries were selected, comprising 60 kilometers, and the rules permitted 16 hours for accomplishing this distance. This route was selected something after the manner of a circus parade, each vehicle carrying among other passengers a judge, who carefully watched the progress of his carriage, making notes of the conditions of road, of speed, consumption of energy, grades, etc.

The first day was taken up in preliminary work, practice runs, limbering up of the machines, etc.

The second day the itineraries, with their side variations were run. Instructions required the judges to note in general the comfort of the vehicle, any annoyance experienced from dust, rain, mud and odors. In operation the ease of handling, guiding, brake action, time required to stop, action on a grade, especially with regard to safety, and the action of the automatic oiling apparatus received special attention. Among the questions asked were the following: Is the motor capable? Is the vehicle noisy? Does it back readily?

The third day 10 vehicles started. The failure of the others was accounted for, one having been injured by collision on the second day, and the other failing to get its accumulators charged during the night. A grade of 11 per cent. in the rue de Magdebourg was readily ridden by all the electric vehicles, while steam carriages had always experienced great difficulty in climbing it.

On the fourth day the route lay across the Pont-Neuf, over the Seine. There were several mishaps which disabled the vehicles.

Over the second route on the sixth day remarkably uniform movements are recorded. The start was made by 10 vehicles, and only two mishaps, in the way of punctured tires, were mentioned.

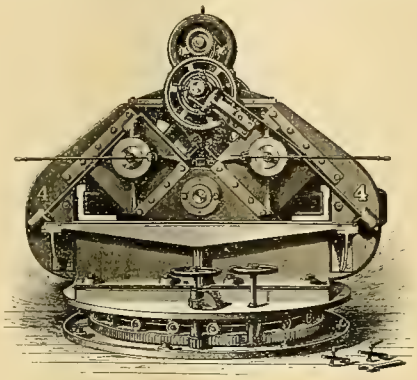
The seventh day brought out the full dozen carriages, the "hospital" was vacated for the first time, but not long, however. Two tires burst; one vehicle ran off the course; a brake failed; a bolt loosened, and one of the carriages took a short cut home, fearing to be caught on the road without energy.

On the eighth, ninth and tenth days the courses were again run. An illustration of the advantage of practice over theory, in an emergency, is mentioned. One of the vehicles came to a sudden halt, and over an hour was spent in looking for the trouble. A vulgar motocyclist happened along, and in less than five minutes modestly hinted to the scientists in charge, that perhaps the thing would go better if they would replace a connector in the battery! and it did.

A variation in the programme was announced for the eleventh day. Endurance had been the principal point at issue. The courses were not extravagantly long, but were made devious. Short spurts off the line, 100 meters or so, and back to the main track, short, sharp grades, sharp curves—to test the suppleness and endurance of the system, had been the order of the day; but now the battery power was to be given severe tests for speed, life, and general behavior under the most adverse circumstances.

Sixty kilometers had been staked off for a day's run of 16 hours. One landaulet had exceeded this distance by 13 kilometers, a cab had added 27½ kilometers, while one heavy fiacre had covered 100 during the day. A 25-meter track on a grade of eight per cent. was laid off on the side of Mount-Valérien for an uphill test, and a similar track of 66 meters—with the same grade—for a downhill trial.

These tests were eminently satisfactory in every respect, and showed that in place of being dangerous and unreliable, an electric carriage is thoroughly governable in speed, direction, and control of every sort.



ANGLE SHEARING MACHINE ELECTRICALLY DRIVEN.

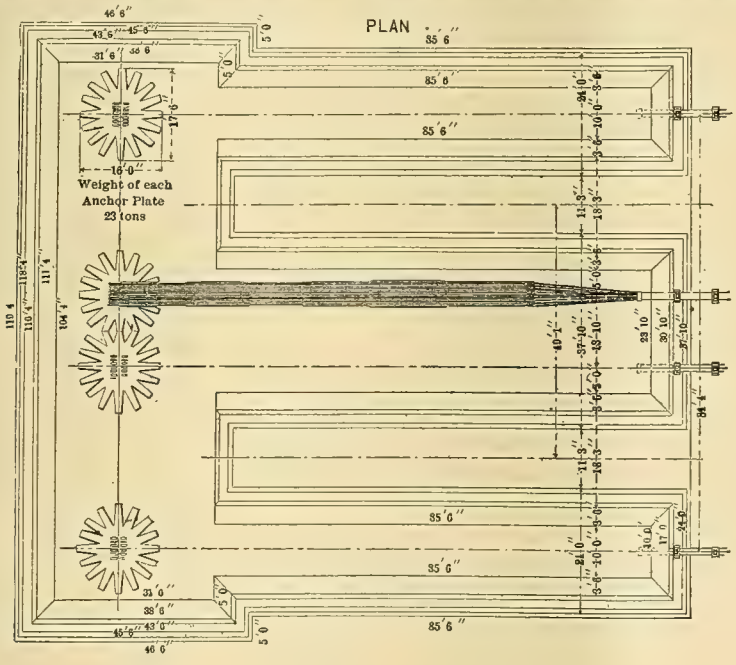


FIG. 7.

AN ELECTRICAL SURVEY IN THE BOROUGH OF MANHATTAN.

Massena Power Project.

The T. A. Gillespie company is making good progress on its contract in connection with the power development at Massena. It will be recalled that the project includes the construction of a canal to connect the St. Lawrence River with the Grasse River, the latter to act as the tailrace from the power house, which will stand on its bank. Seven great steam shovels are at work breaking away the hill near the St. Lawrence, and 12 trains of eight and 10 cars are used to carry away the excavated material. The cut through the bank is of immense size, and it will not be long before the channel is broken through. Two of the shovels in operation at this point are known as the "Vulcan Giants," and it is said there are no larger made. They certainly are powerful machines, and under their influence the hard bank breaks away, two scoops of a shovel filling a car. With the smaller shovels at work at this point last year, it was found necessary to first drill the banks before they would break away.

At the power-house site men are engaged in erecting a centrifugal pump which will be operated by a 125 horse power boiler and a 100 horse power engine. A large steam pump is operated on the north bank of the Grasse River to pump water into the basin, where the centrifugal pump will operate. In this basin an agitator will be used to mix the clay and water and feed the paste to the centrifugal machine. This pump is expected to send 4,000 gallons of liquid earth, 30 per cent. solid, out of the basin every minute to a height of 40 feet. The pump, engine and boiler will be placed on a scow, so that they can be moved about the basin.

At this point a trestle bridge has been built across the Grasse River, to facilitate the removal of dirt from two shovels working on the north side of the river to the south side, where it is dumped. A cable has also been stretched across the river at a height of 75 feet above the water. This cable is supported on movable towers, and over it is operated a scale box, which also carries excavated material from the north to the south side. It is on this cableway that the scale box is operated, and this scale box is filled by a novel machine called the "orange peel." It is so named because of its resemblance to an orange. It is a bucket-shaped affair, having four wings, which open as they drop into the earth with great force. After striking, the wings are closed by means of a chain and levers, operated by an engine. On being raised the wings are released and the earth dropped into the scale box.

Near the canal entrance graders and wheel scrapers are at work, while at the Alden flats two Vivian scrapers are busy. North of the Andrews ridge a great hole has been made by the graders, and on the flats to the south steam pumps are operated to carry the water from the hole excavated by graders.

Both the Racquette and Grasse rivers are being bridged. Both bridges will be crossed by railroad tracks. The piers of the bridge over the Racquette River are finished, and iron is being placed. The abutments of the Grasse River bridge are well under way.

It is estimated that the plant now on the ground belonging to the T. A. Gillespie company is worth $300,000.

Angle Shearing Machine Electrically Driven.

An interesting example of a heavy steel-working machine operated by a direct-geared electric motor is shown by the picture, which represents a double-angle shear, mounted on a turn-table. The machine was built for the Cambria Iron company, and the picture is taken from the Iron Age. The capacity of the machine is equal to shearing eight by eight by one-inch steel angles without disturbing the piece cut off. Angles can be sheared to a bevel considerably beyond 45 degrees, this having been especially provided for in the shape of the main frame. The sliding heads are of cast-steel, each having its separate eccentric shaft, spur gear, clutch, etc., so that two gangs of men can work upon the machine at the same time. The clamping table on the front of the tool is for convenience in securing the bars. All of the knives are of rectangular section with four cutting edges. The turntable is 10 feet in diameter, and can be revolved entirely around for convenience in handling long bars and for shearing to a bevel. The motor is mounted on a substantial bracket secured to the main frame and drives on to the flywheel shaft through a pair of cut gears and a friction clutch. This allows the motor to be started up at full speed before throwing in the flywheel, which is quite a desirable feature, avoiding the possibility of damage from careless throwing on of the current by inexperienced operators. Another good feature of this arrangement is the fact that it makes a slipping point between the motor and the knives.

During the convention of the American Society of Municipal Improvements at Washington last week a paper on electrolysis tests at Dayton, O., was contributed by Harold W. Brown. Mr. Brown argued that the best and most effective way to prevent electrolysis was to break the continuity of metallic pipes at specified intervals by wood pipes backed by concrete. In this way, he claimed, continuous electrical current through the pipes would be avoided. His position was attacked by several members of the society.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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In deciding to hold the next annual meeting of the American Street Railway association in Chicago, the stipulation was made that a suitable hall should be provided for exhibition purposes. No doubt the local managers who extended the invitation to the association intended to comply with this requirement, but thus far nothing has been done, and it would seem advisable to determine upon a plan of action at an early day. There is so much work to be done in preparation for a meeting of this kind that an early start is absolutely necessary to ensure satisfactory results. If the meeting is to be held in Chicago it should be a credit to the city and the local street-railway companies. To make it such the local organization should be undertaken at once.

One of the most interesting documents concerning the operations of the American forces in the war with Spain is the official report of General Greely on the work of the Signal Corps. The importance of the services of this branch of the army is fully recognized now, although it would seem that its usefulness was not fully understood and appreciated before the opening of the Cuban campaign, at least not by General Shafter. It seems rather singular that no provision should have been made for the telegraph train of the Signal Corps which was left at Tampa, and that entire dependence should have been placed upon visual signals; yet these were the original plans, according to General Greely, and it was not due to any foresight on the part of the commander of the Cuban expedition that there was any means of telegraphic or telephonic communication with the rest of the world. It is evident that General Greely resents the lack of consideration shown his department, for in his report he says:

Concerning this telegraphic and telephonic service, which did not fall within the plans of the major-general commanding the Fifth Army Corps and for which he made no provision, the chief signal officer of the army feels it incumbent upon him to point out its absolute military necessity and value and to indicate the extraordinary risks which any general commanding a detached army, especially one serving on a foreign soil, assumes when he leaves himself unprovided with telegraphic or telephonic facilities.

In another part of the same report General Greely says that captive balloons were shown to be valuable adjuncts when properly used, but here again he points out a grievous error in the management of the Santiago expedition:

The forcing of the Signal Corps balloon to the skirmish line, where its position is reported to have caused serious loss to the troops by disclosing their movements and attracting the enemy's fire, was the action of Major-General Shafter, through his chief engineer, Colonel George McC. Derby, in the face of the professional advice given by Lieutenant-Colonel Maxfield of the United States Volunteer Signal Corps, who is charged with the practical operation of the balloon.

It was through the efforts of the Signal Corps that General Shafter was enabled to communicate directly with his subordinate officers, as well as with the admiral commanding the fleet, and to keep in constant touch with the administration at Washington. The Signal Corps also assisted materially in directing the fire of the fleet against Santiago.

Altogether, the record of the Signal Corps was creditable throughout, at Santiago, Porto Rico, Manila and in coast-defense work, although they received no official recognition from the commander of the Cuban expedition.

Some rights of a subway company were defined in the case of the state of Missouri on relation of the National Subway company against the city of St. Louis. The Supreme Court of Missouri holds that the city has control over the streets, and may for the purpose of meeting the necessities of companies using electricity set apart for them a part of its streets upon such terms and conditions as it might reasonably impose, without in any way misappropriating the street or any part of it. Nor does the court consider that an ordinance therefor will be invalid because it does not reserve to the city control over the works.

As to the right of the subway company to charge tolls, or to make an agreement with other companies for the use of its subway, the court says that those are franchise rights, derived from the state alone, and with which the city has no concern.

The mere fact that a subway company, authorized to maintain a line of underground telegraph, is declared by ordinance to be a "common carrier," the court says, does not make it such. It adds that it is the nature of its business by which its character is to be determined, and that, whatever may have been the law heretofore, it is now generally held that telegraph companies are not common carriers. But it does not for that reason follow, the court goes on to say, that the use of the subway company is not a public one. The corporation is not a mere private one for personal gain only, but the business in which it is engaged is for the benefit of the general public, and many companies are now engaged in similar ventures all over the United States and elsewhere. The city may, by the exercise of its governmental powers, by ordinance, require the subway company to allow other companies engaged in similar business to lay wires in its subway; and, while not a common carrier, it is in some respects similar to one, in that messages are sent over wires in its conduit, instead of goods and personal property, as by common carriers. Again, a subway company incorporated under the same statute as telegraph and telephone companies, for the purpose of acquiring, operating and maintaining a line of underground magnetic telegraph, and to lay out, construct and maintain the necessary conduits and subways, the court holds, is possessed of the same powers as those companies. Finally, the court decides that the subway company is entitled to the writ of mandamus to compel the city to take action on its plans and specifications for the completion of its work where it is required to have approval thereof.

The self-complacency of English engineers is well illustrated in their attitude toward the overhead trolley. When this form of street-railway propulsion was introduced in this country, Englishmen gravely announced that it might do for America, but that it would never be accepted in England. Then followed a season of mirth and jest, in which our friends across the water poked all manner of fun at us, and American cities in which the overhead trolley was introduced were held up to ridicule in English journals. It is safe to venture the assertion that there was not an engineer of prominence in England who did not condemn the overhead trolley, that there was not a journal of any standing that did not take a fling at it and that there was not a town council before which a proposition for improved service was considered that did not scorn the idea of approving such an "unsightly" contrivance. They would wait for something better, they said. English engineers would develop an underground or a storage-battery system, or some other method which would put the overhead trolley to shame. They would wait.

Well, they have waited, and what is the result? To-day, the ablest and most progressive public men and engineers in England are advocating the adoption of the overhead trolley. They have assumed an air of ownership which might lead one unfamiliar with the facts to believe that they always favored the overhead trolley, and when a substitute was recently offered, the proposition was met with such a storm of criticism and reproach that one might imagine that some cherished English institution had been assailed.

The English Electrical Review, which is always ready to appropriate American ideas after making fun of them, comments upon recent utterances of Dr. Silvanus Thompson, as follows:

It has been an uphill struggle to convince the public authorities of this country that the overhead-wire system is neither so dangerous nor so unsightly as many have declared it to be, and many have, in spite of conduits, and notwithstanding surface-contact systems, declared themselves in favor of it. Only on Tuesday, at the meeting of the London County Council, the Rev. Fleming Williams spoke of a recent visit to Halifax, where the overhead system was in use, stating that he went there prejudiced against it, but now from practical experience approved of it. No one argues that it is perfect, but the method which is going to supersede it has to convice the army of practical men who have been responsible for the 30,000 miles of overhead trolley which exists to-day. Dr Thompson's utterances may be useful to such bodies as the County Council, the majority of whose members have a rooted aversion to overhead wires; but though it may help to stave off such systems for London, we do not think we shall be brought any nearer to a surface-contact method. The former has proved its utility and its limitations, but the latter has not.

Dr. Thompson is consistent, although he may be wrong, but his critics do not seem to appreciate the fact that his error has really been in following out to their logical conclusion the views which they themselves formerly expressed. They modified their opinions, for which they are to be commended, but they should not seek to divert attention from that fact by clamoring against Dr. Thompson and his associates. One of these days he may come around to the same way of thinking, and ultimately we may expect to find his name prominently mentioned—in English works—as a "pioneer" in this field.

American Industrial Expansion

[Special correspondence of the Western Electrician.]

Washington, D. C., October 27.—There is no more important question before the electrical fraternity of the United States than that of the expansion of trade in electrical goods, and the ways and means of accomplishing it. The proper solution of this question requires the most thorough and exacting study. The search for foreign markets may be said to have developed in late years to an exact, specialized science, in which not only individual exporters and associations, but expert government commissions, elaborately organized, equipped and maintained, lend their efforts to the expansion of export trade. The fact seems to have been proven conclusively that these markets can only be obtained and retained through an intelligent study of the special wants of the different parts of the world, an absolute willingness to cater to those wants, and the expenditure of capital and energy sufficient to make that willingness known.

The consuls can give information about markets, about the kind of goods wanted; they can encourage trade, and this indeed is their chief function; but consuls cannot create trade. The initiative must be taken by manufacturers and exporters. They must understand the market, they must make the goods for it if they really want the market, and they must have active agents on the ground. Consular officers, from time to time, have reported upon the deficiencies in American methods of packing goods and of the conditions of transportation, exchange, banking, etc., with this country, and the disadvantage under which Americans labor, from the fact that European houses give longer credits and more liberal terms of payment. Other nations, too, give special attention to manufacturing certain patterns and quantities of goods and in getting them up in attractive shape to meet local peculiarities and customs. All these subjects are matters of practical importance in considering the means of developing American trade, and are indeed absolutely invaluable to the American manufacturer, who wishes to intelligently understand the conditions which govern the foreign markets, and the character of the obstacles he has to overcome. Manufacturers should use the same care in developing their business abroad as they would at home. They should no longer look upon foreign markets as an unknown world beyond their reach and therefore not worth striving for. They should study their opportunities abroad and profit by the experience of competing nations that have succeeded in introducing their goods in foreign countries in an economical and profitable way. There are two points in which American manufacturers seem to have the advantage: First, the greater excellence and labor-saving quality of machines and apparatus of all kinds; and, second, the more attractive finish, combined with greater durability, of certain lines of goods, such, for instance, as electrical machinery, fittings and kindred lines. These qualities have made a decided impression in the minds of foreign buyers, and this being the case, it would seem that it only requires a certain amount of American "push" and enterprise to successfully introduce such lines of manufactures in the markets of the world. A. F. T.

New York Electrical Society.

The New York Electrical society continues to increase its membership and otherwise give evidence of its prosperous condition. Following is a list of the members elected on October 27th:

Charles E. Speirs	New York
H. Ward Leonard	Bronxville, N. Y.
Harold P. Davis	Brooklyn
John C. Slack	Brooklyn
James H. Mason	New York
W. F. D. Crane	Orange, N. J.
Dr. F. S. Kolle	Brooklyn
William A. Brown, Jr	Philadelphia
Frank D. Sweeten	Philadelphia
William A. Brown	Philadelphia
Charles Shirley	New York
Albert Eckert Chandler	New York
Edward J. Powers	New York
B. F. Hamilton	New York
Mortimer Lewis Newman	New York
Lawrence Strauss	New York
G. Herbert Condict	New York
James Appleton	Philadelphia
Dr. Jean F. Chauveau Jr	New York
George N. Moore	New York
James J. McKenna	New York
H. B. Kirkland	New York
Adolph L. Goldschmidt	New York
John J. Breslawsky	New York
John T. Hunt	New York
William M. Stewart	New York
Horace Dowie	Brooklyn
Hiram D. Torrie, Jr	Riverside, N. J.
Henry M. Jackson	Newark, N. J.
Dudley Farrand	Newark, N. J.

Controller Patents in Interference.

The commissioner of patents has recently decided in favor of Sidney H. Short of the Walker company and against A. J. Wurts of the Westinghouse company in the case of patent applications relating to controllers for electric railways, which were declared to be in interference. The principle of the invention is the use of an initially acting switch in connection with the ordinary circuit-changing and resistance-varying contact cylinder and contacts. The examiner of interferences decided in favor of Mr. Wurts, but the board of examiners-in-chief, on reviewing the case, decided in favor of Mr. Short. Now Commissioner Duell has confirmed the latter decision, and it is expected that the patent will issue to Mr. Short.

Sunday Track-layers Encounter a Wreck.

On Sunday last, proceeding under franchises granted by the city to the General Electric Railway company of Chicago, an effort was made on behalf of that company, which is currently reported to be controlled by the Chicago City Railway company, to lay tracks in Plymouth court and Custom-house court. The work was done on Sunday, presumably to prevent the Chicago and Western Indiana Railroad company, which is opposed to the building of the lines, obtaining an injunction to stop it. Considerable work was done on Plymouth court and a little on Custom-house court and on Dearborn street south of Fourteenth street. A storage-battery car was run for a short distance on Plymouth court south of Polk street.

Finally a Sunday injunction, said to be legal in cases of emergency, was obtained from Judge Payne by the steam-railroad people, and the work was stopped about 2 p. m. In the meantime the employes of the Chicago and Western Indiana company had interposed a physical obstacle by a made-to-order wreck of coal-laden cars across Plymouth court, between Taylor and Twelfth streets. A spur of track was hastily built from the tracks lying just west of Plymouth court and parallel to it, and over this spur a couple of cars were sent crashing across the narrow and muddy roadway into the warehouse of the Grand Trunk Railway company. The cars were derailed and a great hole was made in the side of the warehouse. By this drastic maneuver work was stopped in the immediate vicinity of the wreck, although it was continued on either side. Another coal-car wreck was discovered at Fifteenth and Dearborn streets, about the farthest southern limit of the street-railway people's Sunday operations.

On Monday the wrecks were cleared away, and the contest was adjourned to Judge Payne's chambers, where lawyers argued for and against the dissolution of the injunction. The case was not decided that day, but postponed for later decision.

The Plymouth court and Custom-house court routes pass through a dismal, dirty region of railroad yards and warehouses and evil resorts, but their value lies in the fact that they afford the only available and unoccupied street-car routes from the South Side residence district to the business center of the city.

Stationary Motors on Trolley Circuits.

Last spring the city electrical department and the Chicago General Railway company clashed over the question of supplying current from grounded trolley circuits to stationary motors in shops and factories near the company's overhead wires. In enforcing the city ordinance relating to safe wiring, Mr. Ellicott, the city electrician, was forced to take a firm stand against this practice. After some controversy the city employes cut the wire connecting the adjacent trolley wire with a particular motor, inspection of which, it is said, was opposed by the railway company. The company held that this was an unwarranted and unlawful act, and the city electrician was cited to appear in a state court to give a bond to preserve the peace. Mr. Ellicott's defense was undertaken by the city law department, and when the case came to a hearing before Judge Dunne it was decided that no offense had been committed.

Not content with this decision, the railway company carried the matter to the United States court, seeking a mandate to prevent the city from cutting its wires. Judge Grosscup has just decided this case adversely to the company; that is, he held that the case did not come within the jurisdiction of the United States Circuit Court, as none of the constitutional statutes had been contravened. The court entered an order dismissing the bill.

Proposed Electrical Transmission Plant to Furnish Light, Power and Heat for the City of Denver.

Plans have been prepared for an electrical transmission plant to supply the city of Denver, the necessary power to be derived from water reservoirs to be constructed in the mountains.

Rhodes Brothers of Denver, who are the promoters of this enterprise, recently took the members of the City Council on a trip of inspection to the site of the proposed dam near the station of South Platte, Colorado. The first stop was at the site of the proposed power house, about half a mile inside Platte Cañon. The route of the proposed tunnel was indicated and the next stop was made at South Platte station, where wagons were in readiness to convey the party two miles up the South Fork, to where the proposed dam will be located. Workmen were engaged in clearing the ground preparatory to actual construction.

The location is described as an admirable one for a dam, the cañon narrowing down to about 200 feet, back of which is an area where a lake of probably three miles may be formed.

The plans contemplate collecting water from both the North and South forks of the river. The intake dam on the North Fork will be about 10 feet higher than the storage reservoir on the South Branch, so that in practice the first water used will be from the former, while any excess will be backed up for storage in the latter.

The tunnel and pipe lines from both dams will be about two miles long, joining just east of South Platte. For permanent construction, preference has been given tunnels rather than pipe lines, and the plans call for about five miles. The actual fall of the water from the storage reservoirs to the water wheels is placed at about 750 feet, the last 500 of which will be in a steel pipe, down the side of the mountain from the last tunnel opening, which will give great momentum to the water, as well as enormous initial pressure.

The fall, through the 10-foot tunnels, will be approximately 20 feet to the mile, giving an enormous quantity of water at comparatively light pressure. About three-quarters of the tunnels will be concreted, to hold up the loose rock, as well as to present a smooth surface, to diminish friction. Wherever necessary to cross gullies or streams, steel truss bridges, as well as massive steel pipe, about eight feet in diameter are contemplated.

The cost of the new plant is estimated at $2,000,000, and, in case a franchise is granted, the first power from this source may be had in Denver in less than two years.

Governor Adams, who was included in the party making the tour of inspection, expressed himself as greatly pleased with the outlook and practicability of the enterprise.

Improvement in Chicago South Side "L" Business.

The equipment of the Chicago South Side Elevated Railroad company's system with electricity has been followed by such a gratifying increase in business that the management is highly pleased with the present condition of the road. The plant has operated successfully in every respect, and the large increase in traffic has been handled without the slightest inconvenience.

The South Side elevated railroad finished the first year of its operation on the Union Loop with the largest month's traffic since the days of the World's Fair. The average number of passengers carried daily during October was 58,198. The increase over September was 11,622 passengers per day, a gain of about 25 per cent.

On October 17th the first year of operation on the loop was completed. The total traffic shows a gain of 6,178,498 passengers, or 51 per cent., over the business of the preceding year, an increase from 12,000,000 to 18,000,000 passengers safely carried. The daily average number carried for the year was 50,275 passengers.

The comparison for October, 1898, with October, 1897, shows an average of 53,909 pasengers carried per day during the first 17 days, 66 per cent. gain over the preceding year without the loop, and of 63,405 passengers carried per day during the last 14 days, which, compared with corresponding days of last year, with the use of the loop, shows a gain of 32 per cent. This, however, includes jubilee week, which the management says brought an increase of about 100,000 passengers.

In order to make a comparison between a week with the use of the loop in 1897 and in the present year the figures for the last weeks of October, 1897, and 1898 are furnished. They show 336,034 passengers in 1897, and 389,492 in 1898, a total gain in one week of 53,458, or 15 per cent. under equal conditions.

The road is now earning at the rate of between 3¾ and four per cent. upon its capital stock. During the 11 months of 1897 when the South Side company was in possession of the property the earnings upon the stock were slightly in excess of one per cent. The gain in traffic from the use of the loop increased earnings materially, but the installation of the electrical equipment last spring was fully as important a factor in the present financial showing, for it enabled the management to operate the property for about 55 per cent. of gross earnings, inclusive of loop charges. Since last spring the road has earned a substantial surplus for the stock, and during the last month the earnings were at the rate of nearly four per cent. The prospect of increased business with the approach of winter seems to justify the belief that the end of the year will show earnings of something like 3¾ per cent. upon the stock.

Mr. Short's Multiple-unit System of Car Control.

Mr. Sidney H. Short of Cleveland has a multiple-unit system of controlling electric-railway cars. Mr. Sprague's now well-known system is in successful operation on the South Side elevated railroad in Chicago, and there is a report that Mr. Short's plan is soon to be tried on an eastern elevated railroad. Mr. Short has two patents, issued a few months ago, on his system. He does not, like Mr. Sprague, use electrical means of operating the controllers of the car motors, but his patents broadly cover the use of fluid pressure, including the pressure of air and other gases, for this purpose. Ordinarily the small amount of power required for the motor controller of each car would be obtained by utilizing a little of the air pressure of the air-brake system, a reservoir for compresed air being carried on each car.

The fire-alarm wires in Peoria will probably be placed underground as soon as the telephone company completes its conduits.

DEVELOPMENT OF THE TELEPHONE FIELD.

Right to Suspend Telephone Wires Across Streets.

The recent case of the inhabitants of Summit Township against the New York and New Jersey Telephone company was one wherein it was sought by preliminary injunction to restrain the telephone company from running its wires over certain public streets of the township and to compel it to remove certain wires already erected. The poles upon which the wires were suspended were not located in the public streets, but upon private property, by consent of the owners, and where the wires crossed streets the consent of the owners of the land abutting on the streets at the places of crossing had been obtained, the wires crossing the streets being suspended at an elevation which did not interfere with public travel on the streets.

The right of the township to enjoin the suspension of wires across the public streets was based upon the claim that, under the New Jersey statute relating to telephone companies and an ordinance passed by the township authorities under its authority, the telephone company had no right to suspend its wires across the public streets without the consent of the township committee, and that this consent had not been given.

First of all, it being sufficiently shown that the highways of the township of Summit, or at least the highways involved in this controversy, were streets of a town, and not country roads, the Court of Chancery of New Jersey holds that the township therefore had the power to regulate these streets at the crossings in question, under the state statute.

But the court is just as sure that the telephone company, having erected its poles for its local system, not on the public streets, but on private property, and with the consent of the owners of the soil, did not require any designation or use of the public streets for the erection of its poles, and that the ordinance requiring the previous consent of the township committee to the suspension of wires across the streets was not a regulation of the use of the streets within the statute. The right of the telephone company to the use of the streets for the mere suspension of wires over them, it says, was based on the authority expressly given by the Legislature to use the highway for erecting poles to sustain wires and the consent of the owners of the soil; and this use was not by the statute made subject to the mere discretion of the municipal authorities. They could only regulate and restrict by reasonable regulations.

A right to prevent the use of the streets for suspending wires unless previous consent is obtained, if such a right be lawfully conferred, continues the court, authorizes a refusal to consent at discretion, and confers a virtual power of prohibition. Here the right to the use of the streets had been expressly granted by the Legislature, and, the court maintains, the power to prohibit or interdict this use so granted could not be inferred from the declaration in the proviso annexed to the grant that the use should be subject to such regulations and restrictions as might be imposed. The restrictions intended in such a proviso must be held to be restrictions in the nature of regulations, and not restrictions which should prohibit the use or impose new conditions to the power to exercise the franchise. Such power of prohibition or of imposing conditions upon which the franchise should be exercised at all was not vested in the township authorities by the statute, and the township committee could not, by its own ordinance, confer upon itself this power or the absolute right of previous consent. An ordinance imposing a new condition upon which a telephone company may use its franchise in or over the public streets, granted by the Legislature, is an entirely different thing from an ordinance regulating and restricting the manner of erection and use in or over the streets.

For these reasons the court denied the township the injunction desired in this case.

Affairs of Strowger Company.

Walter S. Strowger and Dr. Alice Strowger have filed a bill in the United States Circuit Court asking that President M. A. Meyer and Treasurer Joseph Harris of the Strowger Automatic Telephone exchange be enjoined from selling stock of the concern. The complainants allege that the funds of the exchange have been recklessly administered, and that Meyer and Harris made presents of shares to their friends. The bill states that the two officers have received large royalities, but will not declare a dividend.

Telephones for Schools.

The Iowa Telephone company is completing arrangements to install telephones in the school buildings at Davenport. Telephones are already in the offices of the superintendent and secretary, in the old high-school building on Fourth and Main, and the company is now stringing lines to the other buildings. There are 12 school buildings in the city, and in the future all will have telephone communication. It is believed that the new system will facilitate the work of the superintendent.

Wisconsin Telephone Company in Sheboygan.

[From the Minneapolis correspondent of the Western Electrician.]

The Wisconsin Telephone company essayed recently to replace some of its old poles in Sheboygan, Wis., with new ones. It has no franchise, but under an order of the court it can replace old poles. It cannot extend its territory, and the mayor instructed the police to watch any attempt to set poles in new territory. The first attempt was soon reported, and the Board of Public Works cut down the pole thus set. A special meeting of the council was called and that body voted to back up any steps the mayor might take to prevent the company from reaching into new territory.

[From the Milwaukee Journal.]

B. K. Miller, attorney for the Wisconsin Telephone company, in discussing the difficulty between that company and the city of Sheboygan, stated that it was due to the opposition of a local telephone company which was favored by the Sheboygan Council and city officials to the detriment of the Wisconsin Telephone company.

Consequently, when the larger corporation attempted some months ago to reconstruct its system by replacing the old poles by new ones, it was stopped by injunction, which, however, was withdrawn before the issue came to trial.

Upon the return of Colonel Born from the war, however, as mayor of the city and one of the chief opponents of the Wisconsin company, he began the old opposition. When poles were erected by the company, he had them cut down. An injunction was served against the city restraining the officials from interfering with the work, which was again resumed. The foreman of the workers and 11 of his men were then arrested and the foreman fined $10 for obstructing the streets with the poles which they were putting up in place of the old ones.

The city also restrained the company by injunction from proceeding with the work further, and the case has been appealed to a higher court.

Pending a decision nothing will be done by the company in the way of further improving their exchange at Sheboygan. As the city is enjoined from cutting the poles already erected, it is said that the property owners will do so.

[From the Sheboygan Telegram.]

Gone.—Superintendent Gallagher and his crew of merry telephone-pole raisers shook the mud of the city from their feet to-day. They have gone to take another fall out of Marshfield.

Telephony Abroad.

A petition by the Montevideo Telephone company for leave to reduce the capital of the company by £60,000 was granted lately. It was asserted that the Montevideo Telephone company was incorporated in 1888, with an original capital of £180,000, divided into 24,000 preference shares of £5 each, and 12,000 ordinary shares of £1 each. A year after incorporation the company increased its capital by £40,000, divided into 5,000 preference shares and 3,000 ordinary shares, all of £5 each. Out of the 29,000 preference shares, 28,000 had been issued and fully paid up, and all the 15,000 ordinary shares authorized had been issued and paid up. It is now sought to write off £60,000 of the capital, represented by £50,000 capital lost, and £10,000 assets which were not available. This it was proposed to do by dividing the existing £5 preference shares each into five separate shares of £1 value, of which three shares only would be preference shares, the remaining two shares being ordinary shares, and by reducing the £5 ordinary shares to £1 shares.

The following paragraphs taken from the London Electrical Review of October 21st, show the present condition of the telephone field in Great Britain:

"Before the York Chamber of Commerce, at Fossgate, on 11th inst., Mr. Dashwood Carter read a paper on 'Improvements of the Trunk System of Telephonic Communication.' The chamber afterward passed a resolution expressing the opinion that the telephonic system is inefficient, inadequate and exorbitant, and favoring municipalization and private-company competition.

"The telephone committee [Glasgow] has resolved, in view of the proposed municipal installation, to erect, as an experiment, an automatic switchboard in the Municipal buildings for trial.

"The Mutual Telephone company [Manchester] has asked the special telephone committee to support its application to the postmaster-general for a municipal telephone license. The committee has decided to interview the postmaster-general to ascertain how the matter stands.

"The telephone question was again brought forward at a meeting of the [St. Pancras] vestry on Wednesday, consequent upon a recommendation submitted by Mr. W. T. Hawkin, chairman of the highways committee. The company sought permission to lay a branch line from Euston road along Gower street, so as to connect the King's Cross exchange and that in the West End, in order to improve the telephone service. Having fully considered the matter, the committee recommended that as a recognition of the easement the application should be sanctioned on condition that the company would undertake to pay 1s. per 100 lineal yards of line per annum. Considerable opposition was manifested against the proposal, and in the end an amendment by Mr. Orange, suggesting that the report should be referred back to the committee, was carried by a large majority."

Bell Interests in the Far West.

The opposition which has developed throughout the country against the Bell telephone interests has been particularly noticeable in the West. The Bell companies are endeavoring to overcome this opposition by calling attention to their facilities for long-distance service. The Rocky Mountain Bell Telephone company, which controls the Bell rights in Idaho, Montana, Utah and Wyoming, has issued a pamphlet which contains some interesting information on the development in that district. The Rocky Mountain company has exchanges in 31 cities, and operates 4,261¾ miles of copper toll lines, connecting with 200 cities and towns in four states. It has two connecting lines with the telephone systems of the Pacific coast—one via Huntington, Oregon, and the other via Spokane, Washington—making complete connections from San Diego, California, on the south, to British Columbia points on the north, and throughout Montana and Idaho. The Utah connecting link is in process of construction. The new line from Boise to Huntington gives speaking connection between Cœur D'Alene points and the capital of the state, and all the Northwest. The new Utah and Idaho line extends north to Idaho Falls, and in another year will be extended to Dillon, completing the link to Montana, and, if possible, west from Pocatello to Boise, thereby perfecting the chain from the crest of the Rocky Mountains to the coast of the Pacific Ocean, and through all the region from near the British Columbia line to Southern Utah, which is nearly as great in area as the original 13 colonies. In 1897 210,772 toll messages were sent over the lines of this company.

Telephone Service in England.

[From London Electricity.]

The telephone grievance is evoking a quantity of correspondence in the daily press, which must be unpleasant reading for the National Telephone company. Here are some typical extracts:

"Our own experience with the telephone, as 'served up' by the Birmingham Central, is that it is the most abominable nuisance we ever had to contend with. The oft-times utter indifference shown to our ringing up and then being repeatedly cut off in the midst of a conversation, which all may hear if they feel inclined, is extremely annoying. Then when the Central does condescend to reply to a ring up, one invariably gets nothing but the parrot-like cry 'engaged,' the latter being, more often than not, to put it mildly, pure invention. A day or two ago, just after 9 a. m., we had occasion to ring up a firm. They were 'engaged.' We rang continuously—that is at various times—during the whole forenoon, but they were still 'engaged.' Finally, just before one o'clock, we had to dispatch a messenger, but after doing so we rang up again, and, wonderful to relate, we succeeded in getting through, when the manager positively assured us that our call had been the first and only one they had received all the morning. . . . To ring up half a dozen times before you get any response, and then to be cut off before one has hardly spoken a word, is the rule rather than the exception, while the phrase 'Number engaged' is, in our experience, more often than not pure humbug.

"With every wish to be considerate to the lady operators, business men cannot afford to waste time to suit their convenience, and if they are so overworked that they may not be entirely responsible for the present state of things, surely the subscribers have a right to demand an increase in the staff to give them what they pay for. In any united action we will willingly join."

It is curious that the Great Monopoly cannot see that it is cutting its own throat by continuing to abuse its power in this fashion. Complaints have been going on for years, and there has been ample time to remedy the matters complained of, but no attempt has been made to improve the service in any way until now. Well, it is to be hoped that the end has come at last.

Telephoned Telegraph Messages.

The Michigan Supreme Court has decided that the Western Union Telegraph company is responsible for failure to promptly transmit and deliver a telephoned telegraph message, through which failure the complainant suffered a loss. The complainant had telephoned to the operator to send a message to Chicago directing a step in a wheat deal. The message was not delivered. The telegraph company claimed that the operator had no authority to receive the message by telephone, and that in so doing he was acting as an agent for the complainant, but the court held that the use of a convenience like the telephone should not be entirely at the risk of the patron.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

A broken telephone wire at Waterloo, Ia., fell across the street-car trolley wire and for a few minutes the switchboard at the central office was spouting fire at all points. The connections were all cut and thus for several hours there was no service. Finally the trouble was located and remedied, not, however, before several instruments were burned out.

A new telephone office has been opened at Estherville, Ia., for the local exchange.

The Wisconsin Telephone company made application for a franchise at Marshfield, Wis., for a long-distance connection some time ago, but was refused. Recently the superintendent entered the city and informed the mayor that he proposed to set poles in the city under a state law. The company proceeded to put up poles, when the mayor ordered it to stop. The company failed to heed the order and the mayor had the poles cut down. The superintendent then discontinued the work.

The Western Electric Telephone company is building a toll line from Albert Lea, Minn., to Cooleyville, via Geneva and Clark's Grove.

A company has been formed at Minocqua, Wis., to build a telephone line to Eagle River, Wis. Work has been begun, and it is expected to have the line in operation very soon.

The city of Stuart, Ia., will vote on November 8th on granting a franchise for a local telephone exchange to the Perry Telephone company.

The Rock County Telephone company is a recently formed organization which is about to put in a telephone exchange at Janesville, Wis.

A. L. Rupe of Princeton, Mo., will have charge of the new telephone exchange at Bloomfield, Ia.

Connection has been completed between San Francisco and Tacoma, making telephone communication possible between the Mexican border and the British possessions. This gives an uninterrupted connection of 2,000 miles, the longest in the United States.

The Spokane and British Columbia Telephone company has brought suit against William Aris and others, stockholders of the company, to recover possession of the offices, books, records, business and lines of the company, which are alleged to be held unlawfully by the defendants. The temporary order of the court was disregarded by the defendants, and an order for their arrest was at once made. The defendants recently sold a controlling interest in the company to J. O'Brien Reddin of Rossland, B. C., and others, but retained 49,000 of the 100,000 shares. They claim that the agreement which assured the minority a place in the management has been ignored. As a result, Aris and others went to Meyer Falls, Wash., and took possession of the offices and books of the corporation, to the exclusion of the plaintiffs. Aris claims that had he obeyed the court's order and given up the office, he would be divested of his rights without having an opportunity to defend himself.

The Mutual Telephone system of Indianola, Ia., now connects with Chariton, Knoxville, Albia and other towns in the county.

The long-distance telephone company of Ottumwa, Ia., is working up a county system in Davis County, Ia. It will include all the smaller towns, and is to connect with the Bloomfield system.

Granite Falls, Minn., now has connection with Clarkfield, and also with nearly every town in that part of the state.

The Iowa Telephone company has settled the case of C. B. Wilbur of Shenandoah, Ia., whose son Vernon was killed by a live wire. The company paid $2,650 to have the suit withdrawn.

The telephone line between Drayton, N. D., and Pittsburg has been so successful that Messrs. McDonald and Whitte are planning to extend the system in the spring to include a central office for Drayton and to build a line to St. Thomas.

The Rocky Mountain Bell Telephone company is stringing another wire between Butte and Anaconda, Mont.

The Southern Dakota Telephone company's lines from Dell Rapids, S. D., to Egan are being reconstructed. The recent sale of the system to the Northwestern Telephone Exchange company has not altered the plans at all. The latter company has recently made a reduced toll rate for night service of one-half the day rate.

The Iowa Telephone company recently gave the people of Webster City, Ia., an opportunity to see what its long-distance service was, by giving free connections with all points. The company gave the people of Boone a similar exhibition of the connections possible over the long-distance lines, at the opening of the new system.

James M. Knapp, assistant superintendent of the American Telephone and Telegraph company of Chicago, was a recent visitor in Black River Falls, Wis. It is understood that the company may make connection from Black River Falls to La Crosse over the old La Crosse line.

The Standard Electric Telephone company has been granted admission to La Crosse, Wis., and it will at once connect its Southern Minnesota system to that point. The toll will be made a flat rate of 15 cents to all points on the line. Connection with the La Crosse Telephone company will be made.

The Eau Claire Telephone company is operating 300 instruments in Eau Claire, Wis.

The Wisconsin Telephone company has completed long-distance connection between Ashland and Hurley Ironwood and Odanah.

The Chariton and Newbern Telephone company has established connection with Des Moines, from Chariton, via Indianola. They also connect with Knoxville, Albia and Bussey.

The Iowa Telephone company has put in a switchboard at Fulton, Ia., and connections with Illinois towns will now be made there instead of at Clinton, as heretofore.

The local telephone company at Washington, Ia., has begun work on a toll line to Crawfordsville.

A local telephone exchange is being installed at Manson, Ia.

The Iowa Telephone company has opened toll-line service at a number of points in the state and has formally opened the line to the public by giving free service the first day. Fort Dodge, Nevada and other towns have been so favored recently.

Arrangements are being completed in Minneapolis to provide telephones for all the voting precincts in order that returns may be telephoned in. Of the 139 precincts about 50 have no instruments in the place, and these will be provided with connections for election day. At the city hall will be a miniature exchange, where the returns will be received. The news will be received much better and quicker than by the old way of messengers.

Negotiations are pending between the local telephone exchange at Fairmont, Minn., and the Northwestern Telephone Exchange company for a traffic agreement.

W. W. Pritchard of Spirit Lake, Ia., and L. M. Foote of Inwood are arranging to connect the towns of the county with Spirit Lake by telephone.

A new switchboard has been placed in the telephone exchange at Rochester.

The Martin Telephone company is changing its system at Webster City, Ia., from a ground to a metallic circuit.

A number of farmers between Boone, Ia., and Mackey have formed a mutual telephone company and will have connection with the Boone County Telephone company's office. The line is now being constructed.

The Woodbine Telephone company has completed connection to Harlan, Ia., and through there to Portsmouth, Panama and Westphalia.

The new telephone exchange at Bloomfield, Ia., is about ready for operation.

Mount Ayr, Ia., will vote November 8th on granting a franchise to the Iowa Telephone company.

It is understood the Mutual Telephone company will extend its wires from Grand Junction, Ia., to Ogden.

The Atlantic, Mount Etna and Corning Telephone company will extend its wires to Creston, Ia., and will there connect through the Smith company's independent lines with a number of points southward, including St. Joseph and Kansas City.

The Greene and Western Telephone company has about 300 subscribers at Mason City, Ia.

The Wolf River Telephone company of Weyauwega, Wis., will extend its system to Berlin, Wis., via Waukau and Eureka.

The Duluth Telephone company of Duluth, Minn., is an applicant for a telephone franchise at Cloquet, Minn., and proposes to build a toll line to that city.

The Ottumwa (Ia.) Long-distance Telephone company is building toll lines to Eddyville, Batavia, Eldon, Keosauqua and other points.

The La Crosse Telephone company, whose toll-line service was recently cut off by the purchase by the Bell interests of its connections, has made a traffic agreement with the Standard Telephone company of Britt, Ia., which will give it more territory and a greater number of towns than under the old arrangement. The Standard company has made a flat toll rate of 15 cents for any town on its line, and a rate war is expected.

The Cedar Valley Telephone company contemplates putting in a telephone exchange at Iowa Falls, Iowa.

Frank E. Bell of Portage, Wis., proposes to establish a telephone exchange at Waupun, Wis., and offers a rate of just half that charged by the Wisconsin Telephone company.

Reinbeck, Ia., will vote November 8th on granting a telephone franchise to the Iowa Telephone company.

Extensions and Improvements.

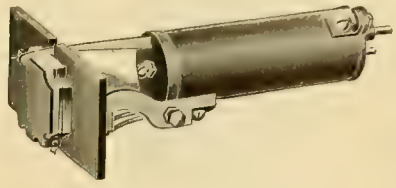
E. E. Fox has been elected president of the Farmers' Telephone company of Massillon, Ohio. The Farmers' company consists of residents of Massillon. Its local exchange has connection with Wilmot, Beach City, Justus, Pigeon Run, Navarre, Dalton, West Lebanon, Burton City, East Greenville, Brookfield, North Lawrence, Canal Fulton, Crystal Spring and McDonaldsville. The lines also connect with the following companies: Millersburg, Coshocton, Mt. Vernon, Newark, Wooster, People's company of Butler, Northern Ohio, and the Norwalk company. Two hundred toll stations in Ohio are now reached and the number is constantly increasing.

A meeting has been held at Cottage Grove, Wash., to formulate a plan for the construction of a telephone line to Bohemia, a distance of 40 miles. The capital stock will be $1,600.

The Long-distance Telephone company has completed the loop between Chattanooga, Tenn., and Birmingham by swinging its wires across the river from the tops of two big 140-foot towers.

Improved Bell Switchboard.

Purchasers of telephone apparatus who favor the Bell switchboards will be interested in the new devices which the American Electric Telephone company is introducing. One feature is a tubular drop, which is herewith illustrated. It is made so that the coil may be removed without touching the adjustment of the armature, and the adjustment is so good and the air-gap so small between the core



IMPROVED BELL SWITCHBOARD.

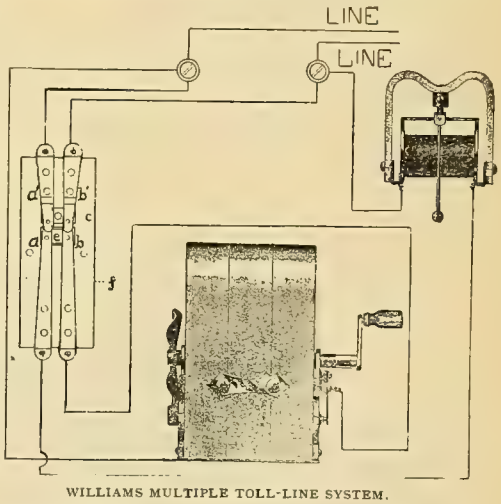
and armature that the drop will fall easily with ordinary series telephones.

There are many points of superiority claimed for the arrangement of the jack and plug in this apparatus, notably the arrangement for fastening the cord in the plug, whereby it is impossible to break the connection—a point that gives no end of trouble in poorly constructed work.

The cam is simple and substantial. Only one lever is used in ringing both ways and listening in the circuit. The operator can talk with one subscriber and ring another with the same lever.

Williams Multiple Toll-line System.

The accompanying illustration shows a new way of connecting telephones in multiple on a toll or party line, which, it is claimed, is non-infringing. The principle of the system is to connect the generator and ringer of every instrument in series with each other, but the different instruments will be bridged across the line in multiple. This is accomplished by means of a double-acting, double-circuit push-button, where f is is a fiber or a hard-rubber block, which has riveted to it contact springs a and b, a' and b' which connect to the terminals of the ringer and generator and to the two line wires respectively. There is also a contact plate c upon which contact springs a and b normally press, thus short-circuiting them or connecting together the free terminals of the generator and ringer. The other terminals of the generator and ringer are connected to the opposite line wires respectively. To operate this bell in sending a call it is necessary to press a button not shown in illustration which removes contact springs a and b from contact plate c and connects them respectively to contact springs a' and b', thus communicating directly with the opposite line wires. This operation throws the ringer and generator, while in the act of sending a call, into direct multiple



WILLIAMS MULTIPLE TOLL-LINE SYSTEM.

connection with the line wires, so that the current impulses from the generator are not weakened or retarded by ringing through resistance coils, but, on the contrary, are delivered to the line in their full strength. The ringers are high wound and the generators are low wound, and the added self-induction and resistance of the generator coil, the latter being in series with the ringer coil, have the effect of making the self-inductance and resistance of each station or instrument that is bridged across the line considerably more than would be the case were they bridged directly to line under all conditions. This being the case, the ringing current will have a tendency to divide more equally along the line. The advantage of this system is especially noticable on long lines of iron wire where the resistance, leakage and static capacity combine to the detriment of good service. The ringers are wound to a resistance of 1,000, 1,600 or 2,500 ohms, as may be specified. The new Williams single-core ringer employed in this system gives to it a very high efficiency, as its construction gives to it an enormous coefficient of self-induction. The Williams Electric company of Cleveland controls this system.

Edison, Jr., Incandescent Lamp.

The cut illustrates the "Edison, Jr., improved incandescent lamp," made by Thomas A. Edison, Jr., of 27 William street, New York. Many advantages, such as high vacuum and full candle power, are claimed for it. The lamp seems to be

EDISON, JR., INCANDESCENT LAMP.

meeting with success—certainly in the case of the Tuxedo Club of Tuxedo Park, N. Y., which, after an exhaustive trial of three sample lamps, ordered a supply. The samples, so Mr. E. I. Wilbur says in a recent letter, won the trade.

Electric Carriage Light.

The cut shows the essential features of the electric carriage light made by the Ohio Electric Works of Cleveland. Current is supplied by eight or 10 cells of dry battery, arranged in a neat case, in series-multiple. The outfits are furnished ready for use and can be attached to any carriage in one minute. The light can be turned on and off at will. The reflector, a true parabola, magnifies eight times the light of the three-candle lamp, causing it to throw its rays 200 feet. The lamp is said to take only one-half watt to the candle power. At an electromotive force of seven volts, it is asserted that only .20 of an ampere is used. The outfit consists of lamp, reflector, combination bracket for attaching to carriage, conductor cord, connectors and eight-cell dry battery, in case; ready for use.

Klein Combination Splicing Clamp.

Mathias Klein & Son, Chicago, have placed on the market a splicing clamp which has met with particular favor. This clamp, which is illustrated in the accompanying cut, is made in three different styles. It is fitted for McIntire sleeves on Nos. 10, 12 and 14 B. & S. gauge, or Nos. 12, 14 and 16 B. W. G. on one side, and for No. 8 and finer iron wire on the other side. Another style is fitted for American sleeves instead of McIntire. The clamps are made with oval or round holes and are fitted exactly to respective size of sleeves. The American sleeve is slightly larger in diameter than the McIntire. These clamps are used all over the country and are said to give the best of satisfaction. Mathias Klein & Son also manufacture other tools of superior quality for linemen and for construction work, and by con-

KLEIN COMBINATION SPLICING CLAMP.

for linemen and for construction work.

Electric Lighting in Washington.

During the last two years many changes and improvements have been introduced in the capitol, but none has attracted more attention than the electrical equipment, especially the innovation of electric lights for the grounds. During the last summer electric lights have been installed in the old Senate chamber, at present the home of the Supreme Court; and this is an addition that has long been needed. At the present time work is being conducted upon the installation of a new electric elevator in the Senate end of the building, and it is expected to be completed before the opening of the next session of Congress. Preparations have also been made for the installation of a 250 horse power machine, a duplicate of the one installed a few months ago on the Senate side, thus making a complete electric-light equipment. Electric power is supplied for the running of electric fans, motors and elevators throughout the building, also for the ventilating fans. The new boiler has a grate surface of 72 square feet and is of 350 horse power, with an extreme capacity of 500 horse power.

Single-phase Alternators of High and Low Frequency.

For alternating-current electric plants in which lights alone are to be considered, with a high-potential distribution, high-periodicity generating apparatus is desirable, both from simplicity and low first cost. When, however, long-distance transmission enters as an important factor, a periodicity of 60 cycles, on account of diminished reactive drop in the lines, allows of transmission over a greater distance than by a high periodicity.

The General Electric company manufactures alternators of 60 and 125 cycles frequency in both

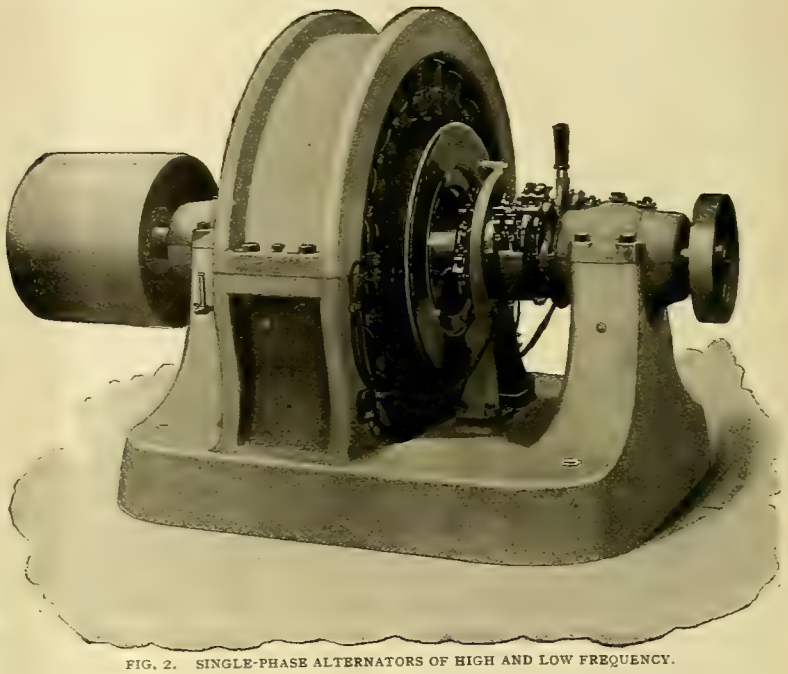
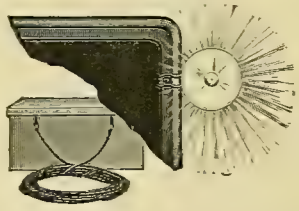


FIG. 2. SINGLE-PHASE ALTERNATORS OF HIGH AND LOW FREQUENCY.

revolving-armature and revolving-field types. Revolving-armature machines of 125 cycles frequency are built in five standard sizes, 30, 60, 90, 120 and 180 kilowatts, each size wound for 1,040 or 2,080 volts. The low-periodicity alternators are wound for 1,040, 2,080 or 3,120 volts and are built in ca-



ELECTRIC CARRIAGE LIGHT.

pacities of 60, 90, 120 and 180 kilowatts. All are arranged for belt driving and are set on rails.

The fields are both separately and self-excited, part of the main current being rectified for the self-excitation. The current for the separate excitation of the fields is derived from a small direct-current generator, driven by belt from a pulley on the end of the armature shaft. The two windings allow of adjustment of the fields to compensate automatically for changes of load, thus giving a practically constant potential at the terminals. The machine may also be over-compounded to compensate for line loss.

The degree of compounding is regulated by a

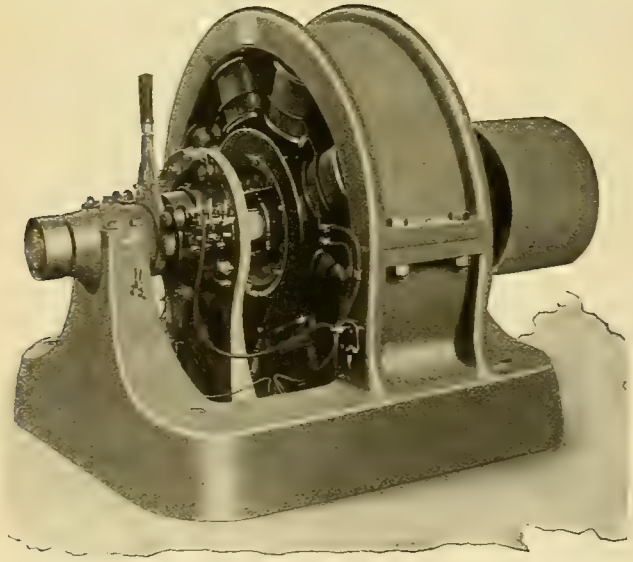


FIG 1. SINGLE-PHASE ALTERNATORS OF HIGH AND LOW FREQUENCY.

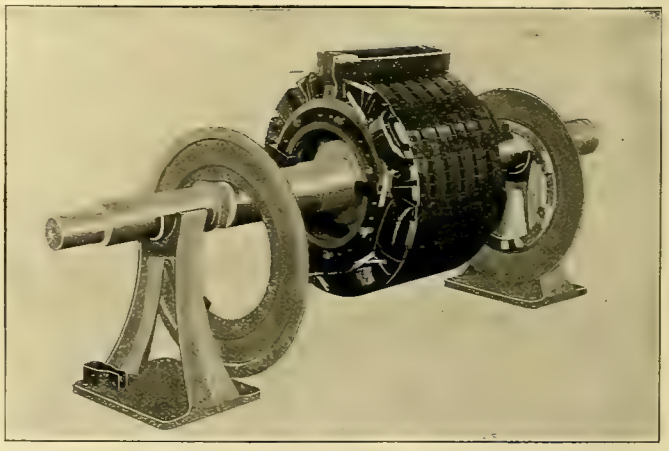


FIG. 3 SINGLE-PHASE ALTERNATORS OF HIGH AND LOW FREQUENCY.

shunt, mounted against the inside of the pillow block at the collector end. It is properly adjusted when the machine is under test at the factory.

The armature is ironclad; laminations of soft steel, built up on a cast-iron spider, form the core, and poles of laminated iron. By this means eddy-current losses are reduced and the reluctance of the magnetic circuit diminished. Both separate and series field coils are wound upon removable spools, the winding of double-covered copper wire being carefully insulated from the spools themselves.

The armature is ironclad; laminations of soft steel, built up on a cast-iron spider, form the core, and each shunt is carefully japanned before assembly, while to guard against eddy currents, thin-paper sheets are interposed between adjoining plates at frequent intervals. The core is thoroughly ventilated by air drawn through the spider and circulating in the ventilating spaces between core and windings. The coils are wound on forms and thoroughly taped and insulated before they are placed in the core, in which they are secured by insulating blocks. They are supported at the end by saddles of light metal, which give ample support to avoid injury by centrifugal force. This method allows of ready removal of any coil when necessary.

Commutators and collectors are of copper of the highest conductivity and are mounted on a metal hub keyed to the shaft. The insulation consists of mica and hard rubber so arranged that short-circuits and grounds are practically impossible. The collector brush-holders are supported on a cast-iron standard and insulated from it by hard-rubber bushings. The commutator brush-holders are supported on a yoke carried by the adjoining pillow block. The bearings are spherical and self-oiling, self-centering and self-aligning, and of ample length to insure cool running.

Each alternator, before shipment, is subjected to most thorough test. The insulation of the separately excited field coils is tested to 3,000 volts alternating and the series coils and armatures at pressures at least double the normal operating voltage.

In the illustrations Fig. 1 shows a single-phase, 90-kilowatt alternator of 60 cycles; Fig. 2 a single-phase, high-periodicity machine, and Fig. 3 the armature of the latter type.

Telegraph and Telephone in the Santiago Campaign.

The great importance of electrical communication in wartime is shown by the report of General A. W. Greely, the chief signal officer of the army, to the secretary of war. General Greely reviews the operations of the Signal Corps during the war with Spain. Referring especially to the Santiago campaign, he discusses the arrangement and installation of electrical and other appliances whereby the War Department, to all intents and purposes, was brought near to the army, and quick communication established between the commanding general and his general officers of the Fifth Army Corps. He intimates that the officers in Cuba were handicapped because they were not allowed to take with them the Signal Corps telegraph train, which had been sent to Tampa for the Santiago expedition, and adds:

"The lack of thoroughly trained men was not the only serious factor that threatened the efficiency of the signal work. Seeing that visual signaling, which the commanding general of the Fifth Army Corps relied upon, contrary to professional advice, was practically impossible for land operations and only useful between the coast stations and the fleet, it is impossible to surmise what would have been the result had it not been for the supply of insulated wire, telegraphic and telephonic instruments, etc., which Lieutenant-Colonel Allen furnished to Lieutenant-Colonel Green."

General Greely discusses at length the physical difficulties of maintaining communication by wire in Cuba in the Santiago campaign, but points out that at all critical periods of the campaign General Shafter was kept in direct communication by telephone with his subordinate commanders, the lines being uninterruptedly maintained under an almost constant fire from the enemy. Special stress is laid on the value of the Signal Corps' facilities in directing the fire of the naval vessels. The arrangements were so complete and excellent that the major-general commanding was able to communicate directly with the admiral commanding the fleet, and in addition to communicate with the War Department within 20 minutes. General Greely then says:

"Concerning this telegraphic and telephonic service, which did not fall within the plans of the major-general commanding the Fifth Army Corps, and for which he made no provision, the chief signal officer of the army feels it incumbent upon him to point out its absolute military necessity and value, and to indicate the extraordinary risks which any general commanding a detached army, especially one serving on a foreign soil, assumes when he leaves himself unprovided with telegraphic or telephonic facilities."

General Greely is confident that in the single month of July the lines of communication maintained by his corps in Cuba were worth more to the nation than the cost of the Signal Corps from its inception to the present day. He refers to the ease with which the major-general commanding the army communicated with Washington, giving important information and receiving important orders. He then adds:

"In addition, it is not pleasant to surmise what might have been the fate of the fever-stricken army in Santiago de Cuba had its fortune and movements been debated by mail instead of by electrical communication."

General Greely's report indicates that the credit for the location of Admiral Cervera's fleet in Santiago Harbor belongs to the Signal Corps. He says:

"In the interest of history, let alone justice to the Signal Corps of the army, the truth should be told. The location of Cervera's squadron at Santiago was first made by Colonel James Allen, and later verified independently by Lieutenant-Colonel Joseph E. Maxfield, both officers of the Signal Corps. The blockading of Cervera's squadron was due to the conservative action of the president and secretary of the navy, based on reports and representations made personally to them by the chief signal officer of the army."

The report says that Colonel Allen furnished cipher advices of the most valuable sort from Santiago almost daily, and adds:

"A cipher message of the 23d stated correctly that Admiral Schley was that day at Cienfuegos, and Cervera was at Santiago. Meanwhile the Navy had been unable to verify the fact of Cervera's presence at Santiago, and, and as a result, the correctness of the information furnished by the Signal Corps was sharply questioned. The chief signal officer, being informed that the whole campaign was conducted upon his representations, was asked to verify this information from other sources, if possible. Prompt action was taken by the chief signal officer, who adopted such lines of operations that thereafter there was scarcely a day he was not in possession of information coming over one or more of the six cables leading out of Santiago.

"It is an interesting anti-climax that when Cervera's squadron was destroyed, on July 3d, Colonel Allen, the same officer who originally reported the arrival of the fleet on the very day it reached Santiago, likewise reported by telegraph to the chief signal officer the fact that the entire fleet had been destroyed, which information was conveyed to the president and the country 14 hours in advance of any other official advice."

General Greely gives an account of the operations of the Signal Corps in Porto Rico, adds some suggestions as to the telegraph lines in Cuba and Porto Rico, and strongly advocates an increase in his force.

CORRESPONDENCE.

New York Notes.

New York, October 31.—As is very well known, the laws of West Virginia are favorable to the incorporation of companies intending to establish their principal offices outside that state. Many New York companies are chartered by the state of West Virginia. Two such incorporations of last week have an interest to electrical men. One was that of the Porto Rico Prospecting and Development company of this city, with a subscribed capital of $500 and the privilege of increasing the amount to $400,000. The object of this company is well indicated by its name. Among other things, it proposes to establish telephone and telegraph lines. The other company is the Edison Junior Electric Light and Power company of New York city, incorporated for the purpose of "manufacturing, selling, licensing or otherwise dealing in electric or storage batteries and electrical appliances, etc." The capital subscribed is $100, with the privilege of increasing it to $500,000 in all. The shares are $10 each, and are held by Thomas A. Edison, Jr., Valentine Robinson, H. C. Hepburn, E. A. Drake, C. S. Henry, R. M. Jordan, J. G. Batterson, Jr., and F. J. Stone, all of New York city.

There was much rejoicing along the Eighth avenue street railway on Friday night, the opening of the new electric line being the occasion of it. The celebration was in charge of the West Side Improvement association. Twenty-five electric cars were run over the line, and music and fireworks told the citizens of that part of the city that rapid transit had at last come. The start was made from Fourteenth street at 8:30 p. m. There were several thousand people on hand to cheer when the cars started. In the first car was a band, a number of members of the Ninth Regiment, James W. Boyle, Alderman Keahon, Assemblyman Maher, Assistant District-attorney McClelland, Coroner Hart and Commissioner Keller of the Department of Charities. The remaining cars were thronged. The cars bore canvas banners, among them one with the inscription, "Congratulations to Citizens of the West Side." The run downtown was also marked with plenty of fireworks and music by the band. At Seventeenth street the men in the cars got out and attended an open-air meeting.

It is said that the fare for electric-cab service is to be reduced from 50 cents to 30 cents a mile or part of a mile. It is believed that in winter the big pneumatic tires will have a marked advantage on icy pavements. The new broughams will seat three passengers.

Mr. Knudson's paper before the Institute on last Wednesday evening attracted much attention. Under the title "An Electrical Survey in the Borough of Manhattan," the author discussed the prevalence of stray electric currents in this city, as shown by a number of measurements of difference of potential between various metallic structures, such as elevated-railway pillars, surface railways, buried pipes, etc. Mr. Knudson disclaimed the intention of appearing as an alarmist. He thought the danger from electrolysis might become serious in time if no steps wre taken to avoid it. However, the leakage could be prevented by methods perfectly well known. It was simply a question of expense.

Referring to the recent reduction in rates by the Edison Electric Illuminating company and the United Electric Light and Power company, coincident with the incorporation of the New York Gas and Electric Light, Heat and Power company, the Tribune makes these observations: "The most striking feature of the United company's new schedule is that its maximum rate, which applies to the smallest customers is by one stroke reduced from one cent per lamp-hour, which has been the rate for years, to three-fourths of a cent, and, while the reduction to large customers is considerable, the proportionate reduction in the case of small consumers is much greater. The United company claims that under its new schedule it offers electric lighting at lower rates than it can be obtained in any other city of the United States or any other country. It will now be interesting to observe the action of the Edison company and of the new, mysterious electric-lighting enterprise recently incorporated at Albany with a nominal capital of $25,000,000. In any event, it seems certain that as the result of the pending competition, the people of New York are sure to receive their electric lighting at a much lower rate than heretofore. As to the effect on the lighting companies themselves, opinion is divided, but many of the most intelligent men in the business claim that the present reduction in rates will be a blessing in disguise, in view of the certainty that lower rates will popularize electric lighting and greatly extend the operations of the existing companies." M. S.

PERSONAL.

C. S. Knight, vice-president of the Fort Wayne Electrical corporation, was in town last week.

The London Daily Mail says that the late Dr. John Hopkinson left an estate valued at over $350,000.

City Electrician Stern of Denver was in Chicago on Saturday last, making a short stop on an eastern trip.

Stephen H. Goddard, the advertising manager of the Electrical Review of New York, was in Chicago early in the week.

Announcement is made of the wedding at Toledo last week of N. Coe Stewart, Jr., to Miss Ruth Griffin. Mr. Stewart is connected with the General Electric company at Lynn.

Channing T. Gage, the northwestern agent of the Washburn & Moen Manufacturing company, has removed his office from St. Paul to the Lumber Exchange building, Minneapolis.

Charles Blizard, the New York representative of the Electric Storage Battery company, was in Chicago a couple of days last week escorting a friend who desired to inspect the large battery plants in this city.

Clarence G. Davenport, formerly expert and agent of the General Electric company at New York, who went to Porto Rico with the First Regiment Engineers, U. S. V., died of typhoid fever at Ponce on October 26th. He had been an associate member of the American Institute of Electrical Engineers since November 21, 1894.

Those who made the last midsummer Northwestern electrical convention trip on the steamer Northwest will be shocked to learn of the death in St. Paul of Mrs. Patrick H. Scanlan, wife of the traveling passenger agent of the Chicago, Milwaukee and St. Paul Railway company, who had been delegated to accompany the association during this memorable trip. Mr. and Mrs. Scanlan made many friends among the electrical people of the Northwest.

Cards are out for the marriage of Arthur Clifton Garrison and Miss Frances Billingsley of St. Louis. Mr. Garrison is secretary of the Columbia Incandescent Lamp company, and he has been so busily engaged in conducting the affairs of that prosperous concern that none of his friends realized he contemplated an event of so great moment as that which he now announces. However, they unite in extending him their congratulations, and the best they can wish him is that he may enjoy all the prosperity and happiness that he deserves.

Mr. John Lundie has removed from Chicago to New York to act as consulting electrical engineer for the Brooklyn Elevated Railroad company, and he is now preparing the preliminary plans for changing the motive power of the Fifth and Lexington avenue lines in Brooklyn from steam to electricity. Mr. Lundie is a graduate of the University of Edinburgh. In Chicago his work for the Illinois Central Railroad company, in considering the problem of the substitution of electrical power for steam on the suburban trains attracted much attention.

Queen Victoria has conferred upon Lord Tweeddale the decoration known as the Ribbon of the Thistle. Since his lordship quitted political life, in 1878, he has been deeply and actively engaged in

the management of telegraph companies, and he succeeded the late Sir John Pender in the chairmanship of those which are known as the "Eastern" group. He was one of the first directors of the cable from Malta to Alexandria, which was the nucleus of the vast and complicated system that connects London with the Far East to-day. Indeed, he is the only surviving director of all the original Pender companies.

LITIGATION.

Philip Stump, an employe of the Western Union Telegraph company, has filed a suit in United States court at Toledo, asking for $10,000 damages from the company for personal injuries. He says he was ordered by one of the foremen to climb a certain pole and remove some wires, and, while so doing, the pole broke off near the bottom, throwing him to the ground and permanently injuring him.

A dispatch from Dubuque, Ia., dated October 28th, says that Judge Shiras of the Federal Court, in the suit of the Old Colony Trust company of Boston against the Dubuque Light and Traction company, has decided in favor of Doane & Co., former owners of the Eighth street railway, holding that the latter is entitled to revision of contract by which the line was sold to the traction company. The suit was one of several involving property said to be valued at half a million.

A jury in the Circuit Court at Kansas City has decided that the Western Union Telegraph company cannot libel a person. W. J. Meeker, who lives at Caney, Kan., numbers among his acquaintances J. W. Jordan, who lives at Cross, O. T. One day Meeker received the following telegram from Jordan: "Your sweet lies give you the advantage of me, use it if you like and learn who you are robbing. Pay your own messages." Meeker went to Kansas City and filed a suit against the Western Union Telegraph company for $2,000, claiming he had been held up to public shame, obloquy and disgrace by the company accepting the message for transmission. He asked that he be given $1,000 for the damage to his reputation and another $1,000 to punish the company for sending any such message over its wires. The jury found for the telegraph company.

ELECTRIC LIGHTING.

The Decatur, Ill., Light company is figuring on building and operating an electric-lighting plant at Litchfield.

Sherman, N. Y., is to have electric lights. The King company of Corry, Pa., has the contract for the plant, and work will begin at once, the $24,000 of stock having been subscribed for.

At a meeting of the officers of the Merrill, Wis., Railway and Lighting company on October 25th it was decided to rebuild the electric-lighting plant on a larger and more complete scale than ever.

Current for incandescent-lighting circuits in Hamilton, Ont., is furnished from the plant of the Cataract Power company at DeCew's Falls. The service is said to be an improvement on the old order, as the regulation is much better. Current will soon be furnished for arc lighting from the same plant.

The Utah Power company has agreed to furnish Salt Lake City electric lights of the value of $1,000 yearly for the next 23 years by way of compensation for its franchise. The company is to light the city jail, the stable and supply house of the waterworks department and maintain 10 2,000 candle power arc lights wherever the city may direct.

The overhead festoon lighting on State street, Chicago, from Randolph to Van Buren streets, which was such a conspicuous feature of the Peace Jubilee decorations, as described in the Western Electrician last week, will be continued during the month of November. The Chicago Edison company will supply the current, the expense being defrayed by merchants and street-railway companies interested in the display.

The repealing ordinance taking away from the Edison Electric company the authority to light the Seventh, Eighth and Ninth Districts of Cincinnati was passed by the Board of Legislation on October 24th. This action was taken upon the ground that under its contract the Edison company should have lighted these districts long ago, and that failure to live up to the agreement justified the board in its action. The board is also considering the advisability of holding the company to the terms of its contract in the matter of candle power furnished.

The extensive electric-light and ice plant of the Edwardsville, Ill., Electric Lght and Power company was totally destroyed by fire on October 24th. Employes attempted to secure the books, but explosions drove them off. The fire is supposed to be due to spontaneous combustion or the explosion of an ammonia tank. The company supplied the city with light, and operated 80 arc and 2,500 incandescent lamps. It also manufactured ice, the plant having a capacity of 18 tons daily. The corporation is composed of St. Louis capitalists. The following-named gentlemen compose the board of directors: Henry Wiebusch, Sr., Frederick Gut, C. H. Fischer, G. H. Wetteran and Charles A. Vallette. A 10-year franchise was granted the company in 1892. A modern electric plant had been installed, which was designed to meet the requirements of a reasonable growth in the city, and it had been enlarged from time to time. The ice plant was added two years ago. The company's loss will reach $30,000, with insurance of $16,000. The plant will be rebuilt. As the company has an exclusive franchise, the city will be without light until a new plant is installed.

The troubles of Geneva, N. Y., over lighting matters are apparently far from ended, as Mayor Herendeen has vetoed the second contract approved by the council. When Geneva became a city last January, the first thing the aldermen did was to take up the lighting question, with the intention of having the question settled and contracts executed by May 1st, when the contract then in force would expire. But the aldermen could not agree on the kind of light they wanted by that date. Some weeks ago they reached an agreement and drew up a contract for five years. This was vetoed by the mayor, who also filed an opinion by the city attorney that the city could not make a contract for more than one year. The second contract proposed by the aldermen was for a period of five years, and this the mayor has vetoed. His objections are: That the electric-light company does not agree to furnish the 2,000 candle power lights formerly agreed upon; that the contract does not require the 3,500 hours of lighting, before offered; that a valuable franchise is given away contrary to law, and one which others are willing to pay for; that the city cannot enter into a contract for a longer time than one year.

ELECTRIC RAILWAYS.

There is talk of a stock company being formed to build an electric road from Dansville to Mount Morris, N. Y., and then to Geneseo and Conesus Lake.

President Calkins of the City Council, who is acting mayor of Kenosha, Wis., has vetoed the ordinance pased October 24th granting the Milwaukee, Racine and Kenosha Electric Railway company a franchise to construct its road through the city of Kenosha.

The property owners along the "Old Fort Route," between Lewiston and Youngstown, N. Y., have commenced improvements along the line. Many of the property owners are stockholders in the road. Henry C. Howard has started the movement by laying out a little park. He is a banker.

The Niagara Falls and Suspension Bridge Street Railway company has announced its intention to lay 94-pound rails on Second street in Niagara Falls next spring, and has asked that the paving be delaved until then. Over this section of the road the Gorge cars are also run but the improvements may prove the first step of preparation for heavy travel through the city over a belt-line route across the bridge to be built at Lewiston.

The City Council of Cleveland recently passed ordinances imposing four-cent fare on the "Big and Little Consolidated" railway systems. Both companies began suit in the United States Circuit Court, asking for an injunction preventing the city from carrying the ordinances into effect. The ground taken by the companies is that the action of the City Council amounts to an attempt to arbitrarily seize private property. A temporary restraining order was issued, good until December 1st, when the case will be heard

There is a serious street-railway strike in London, Ont. The men ask that their wages be increased from 13 to 15 cents an hour, but their request was refused by the London Street Railway company, which also refused to recognize their union. French-Canadians were brought from Montreal to replace the strikers, but the trolley wires were cut and obstructions were placed on the tracks and the cars could not be moved. It is feared that there will be bloodshed. H. A. Everett, the well-known street-railway magnate, is president of the London company, which operates over about 30 miles of track.

A test of a new closed-conduit system was made at Leeds, England, recently. The car can be fitted to run either over conduits or under overhead wires, so that overhead wires can be used in less crowded districts and conduits in central thoroughfares. Instead of a continuous groove along the line, there is nothing to be seen but a series of iron plates, each about three feet long and one foot broad, and placed between the rails at intervals of about 18 feet. This plate is really the upper side of an underground box. On a level with the plate are the heads of two pegs, one for each direction in which the car travels. As the vehicle passes over the plate one of the pegs is magnetically drawn about four inches above the surface, and conveys the current to the motor. The distance between the plates is practically the length of the car, so that only one peg is elevated at a time.

H. E. Woodford of Niagara Falls has won his famous damage suit against the Niagara Falls and Lewiston Railway company. The plaintiff owns a flour mill at the edge of the high bank, close to the lower steel arch bridge. The mill is operated by water power supplied by a wheel at the water's edge. It was claimed that the building of the Gorge road seriously interfered with the operation of the mill. Action was brought to have the power plant and vicinity restored to its original condition, while another suit was for damages sustained by reason of the loss of power. The case was given to a referee, who finds that the company should restore the land in the vicinity and any power development they have interfered with within three months. Failing to do this, the company should pay Mr. Woodford $15,000 damages for the power and damages of $2,167 for temporary loss of power.

The village of Kenilworth has again refused to grant a right-of-way to the Bluff City Electric Railway company, now the Chicago and Milwaukee Electric company. The street-railway company asked for the use of the unopened street east of and bordering the Northwestern tracks, in addition to the other privileges necessary to the succesful operation of its lines. The trustees insist that the tracks shall be placed west of the Northwestern tracks, and have held out for over a year, although every other suburb along the North Shore, between Chicago and Waukegan, has granted the franchise. During the last few days the construction engineers of the road have been over the ground between Highland Park, the present southern terminus of the road, and Evanston. The general survey of the territory has been for the purpose of ascertaining the feasibility of connecting with the Chicago, Milwaukee and St. Paul suburban branch at Wilmette. It is generally understood that the road is to connect with the electric line at North Evanston, but recently one of the long cars of the Bluff City line was run over the North Shore electric, from Edgewater to North Evanston, and it was found that the short curves could be made only with considerable difficulty. The Bluff City line must be in operation between Evanston and Waukegan before next July.

POWER TRANSMISSION.

The Seattle, Wash., Post-Intelligencer says that the Snoqualmie Falls Power company is preparing to erect poles in that city.

Dr. M. J. Ricoff of London, England, who is at the head of a syndicate, passed a few days recently in Colorado, for the purpose of examining Lake Park reservoir site, seven miles from Leadville. His company proposes to erect an electric-power plant for the purpose of furnishing power to the mines and smelters of the Leadville camp. Dr. Ricoff's principal object was to get the promise of a number of leading mine managers and smelter men to use the power in case the plant is installed.

TELEGRAPH.

At a meeting in London, last week, of the Eastern Extension Telegraph company, the Marquis of Tweeddale, the chairman, said that the company's claim against the United States for cutting the Manila cable had not yet been admitted. The occupation of the Philippine Islands by the American forces, he said, had given a great impetus to the project of building a Pacific cable, but, he added, nothing definite has yet been arranged.

ELECTRICAL SECURITIES.

New England Telephone and Telegraph company has declared a dividend of $1.50 per share.

The American District Telegraph company has declared a dividend of one per cent., payable November 15th.

The Hudson River Telephone company is reported to have earned $100,000 net in nine months of the present year.

The Erie Telegraph and Telephone company has declared a quarterly dividend of one per cent., payable November 21st.

The Saint Anne Light and Water company, St. Anne, Ill., has certified to an increase in capital stock from $15,000 to $20,000.

The dividend rate on stock of the Metropolitan Street Railway company of Kansas City has been increased from one-half to one per cent. quarterly, beginning November 1st.

The gross earnings of the Brooklyn Rapid Transit company for the year ended September 30th were $5,912,891, net earnings $2,195,270, gross income $2,438,151, surplus $368,220.

The Des Moines Edison Electric Light company has increased its capital stock to $450,000. Plans are formed for the improvement of the company's water power plant, a new building being now in process of construction.

The Newport News and Old Point Railroad and Electric company has purchased the Newport News, Hampton and Old Point Electric Railway company, giving a mortgage to secure $900,000 five per cent. gold bonds to the Maryland Trust company.

The proposed $3,000,000 increase of stock of the New York and New Jersey Telephone company,

which is to be used for extensions of the system, is to be offered to the stockholders at par.

The following figures are presented in the report of the Metropolitan Street Railway company of New York for the quarter ended September 30th: Gross earnings $2,907,562, operating expenses $1,466,641, net earnings $1,440,921, other income $181,737, total $1,622,658; interest, taxes, etc., $1,070,849; surplus $551,809. It is gratifying to note that although the expenses were considerably higher than the last year, the net earnings showed improvement, and in other respects the report is entirely satisfactory.

The Long Island Electric Railroad company's report for the quarter ended September 30th contained the following facts: Gross earnings, $34,199; operating expenses, $18,566; net earnings, $15,633; other income, $1,743; total income, $17,376; fixed charges, $10,393; net income, $6,983. The general balance sheet shows cash on hand $591 and profit-and-loss surplus $6,989. By comparison with the corresponding quarter of last year an improvement in gross receipts is noted, but this is offset by the increase in operating expenses and fixed charges, leaving the net income $852 less than last year for the same period.

NEW INCORPORATIONS.

The Foos Manufacturing company of Springfield, Ohio, has been authorized to increase its capital from $30,000 to $75,000.

The Sands Electric company of Cleveland has been incorporated, with $10,000 capital, to manufacture all kinds of electrical appliances. The incorporators are L. Sands, Edward Velhagen, F. B. Skeels, C. R. Hunt and O. A. Bejck.

Articles of incorporation of the Fort Smith (Ark.) Traction, Light and Power company have been filed by Alfred N. Sicard, Ella E. Sicard, Richard C. Kern, Charles H. Smith, J. E. Foster, Joseph M. Hill and James Brizzolara. The capital stock is $200,000, of which $100,000 has been subscribed and paid up.

The Dundas, Ont., Electric company has been incorporated, with a capital stock of $40,000, for supplying steam, heat, electricity or natural gas for heat, light and power. The company includes George Hamilton Harper, Richard Todd Wilson, James John Grafton, Emilie Beatrice Harper and John Bertram of Dundas.

The Tonawanda Cataract Power company has been incorporated to furnish electricity or other power, with headquarters at North Tonawanda, N. Y. The capital is placed at $100,000 and the directors are Ed. D. Adams, Francis Lynde Stetson, E. A. Wickes, W. B. Rankine, Charles A. Sweet, Lincoln A. Groat, Delancy Rankine.

The South McAlester Electric Light company has filed articles of incorporation with the secretary of state at Little Rock, Ark. The incorporators are A. C. Graham, J. T. Miller, W. J. Wade, Joseph R. Foltz and W. P. Andrews of Fort Smith, where the office of the company will be located. The capital stock is $25,000, of which $5,000 is paid up.

The International Facsimilegraph company of Cleveland was incorporated on October 28th by Dr. William P. Dunlarry, Thomas Mills, H. F. Fulton, Alex S. Taylor and William F. Dettelbach, to manufacture electric telegraph devices for the transmission of art pictures, sketches, photo-engraving plates, autographs and autographic work.

The Rochester Electric Service company has been incorporated with a capital of $1.000. Its objects are stated to be the manufacture and use of electricity for light, heat and power in lighting streets, avenues, public parks and places in the city of Rochester, N. Y. The directors are John W. Cook, Jr., F. Fish, Miner S. Horton and G. B. Newman.

MISCELLANEOUS.

An ordinance has been passed by the Grand Rapids, Mich., Council granting a 30-year franchise to Alfred C. Sekell to operate an electric-light, heat and power plant in that city.

Sealed proposals will be received at the office of the city electrician of Chicago in the City Hall, until 11 a. m., November 9th, for furnishing repairs on arc lamps for the Department of Electricity, according to specifications on file in the office.

The recently organized Kalamazoo Valley Electric company has begun the construction of a dam in the Kalamazoo River, near Allegan, Mich., at a cost of $125,000, to develop 13,500 horse power. The current will be distributed to the nearby towns for lighting and power purposes.

By the efforts of Mr. Peck, the United States commissioner at Paris, the space allotted to this country at the Paris Exposition has been increased to 210,000 square feet. Of this space 59,000 square feet have been set aside for the American exhibits, classified as "general machinery and electricity."

General Wilson estimates that the sum of $4,917,500 will be necessary for the work of fortification and defense for the fiscal year of 1899-1900, of which $100,000 will be expended for torpedoes for harbor defense, for the purchase of submarine mines and necessary appliances to operate them, closing the channels leading to the principal seaports; for needful casemates, cable galleries, etc., to render it possible to operate submarine mines, and for continuing torpedo experiments.

An electrical canceling machine is being introduced into the postoffice at Youngstown, O. The apparatus is run by an electric motor and is capable of cancelling 360 letters per minute. The machine is furnished with changeable type and a self-inking roller, and is fed somewhat after the style of a printing press, although less pains are required in getting the letters in straight. The mail matter is dropped into a trough at the bottom of which is a belt which carries the letters to the printing part of the machine, where the postmark, date and name of the city are printed on the letter. After the letter is marked it is carried by a continuous belt to a trough-like box, where the letters are delivered in the same manner as newspapers from a perfecting press..

The Bureau of Supplies and Accounts of the Navy Department is inviting sealed proposals until November 15th for furnishing the navy yard at Portsmouth, N. H., a quantity of electrical apparatus, including two 1,000-ampere, single-pole, double-throw machine switches; one 1,000-ampere Weston illuminated-dial ammeter; one 150-volt Weston illuminated-dial voltmeter; one ground detector switch, one three-point voltmeter switch, two 500-ampere, double-pole, double-throw feeder switches; two 300-ampere, double-pole, double-throw feeder switches; four 200-ampere, double-pole, double-throw feeder switches; one double-pole lightning arrester, one steam engine, to be of sufficient size to drive on direct-connected 100-kilowatt generator, at a speed of 250 revolutions per minute and to supply and install on the extended plate of the engine one 100-kilowatt dynamo. The dynamo is to be of the multipolar type and compound wound, operating at 115 volts. One 40 horse power motor, two 25 horse power motors, one 15 horse power motor and one five horse power motor are also needed. Prospective bidders can obtain detailed specifications, blank forms of proposals and other information upon application to the paymaster-general of the Navy, Washington, D. C., or to the navy yard at Portsmouth.

TRADE NEWS.

The American Electric Telephone company of Chicago was awarded one of the highest two awards or medals for telephone apparatus at the Omaha Exposition.

The Charles E. Gregory company of 58-62 South Clinton street, Chicago, has purchased the assets, stock and good-will of the defunct Electrical Exchange for $3,725.

The Stromberg-Carlson Telephone Manufacturing company announces a constantly increasing demand for its divided-circuit toll-line apparatus for central checking system, for replacing lines where the regular series or bridged instruments had formerly been adopted, as well as for new work.

The Helios Electric company of Philadelphia, through the Anchor Electric company, its Boston agent, has received a large order from Jordan, Marsh & Co. ofBoston. It was only after protracted and severe tests of prominent lamps on the market that the order was finally awarded to the Helios company. Large orders have also been received from abroad, taxing the facilities of the factory to the utmost.

The Leather Preserver Manufacturing corporation of Chicago makes a proposition which is of special interest to belt users. The corporation guarantees to put in first-class condition belts that are oil-soaked, dirty or in such condition that they slip on pulleys. The company requests belt users to send such belts, and if the figure quoted for putting them in condition is not satisfactory the company will return the belts by freight, prepaid. The Leather corporation also requests those who have old belts to sell to send them in, and it will make an offer for them; if the offer is not satisfactory the corporation will return them, prepaid. The concern is also willing to furnish any information about belting.

The Mutual Electric company of 1218 Marquette building, Chicago, which does construction work, is wiring the new Garrett building at Lake and Market streets for 2,000 lights and 200 horse power in motors. The company is also building the switchboard. Iron conduit is used throughout. Current is to be supplied by a plant on the premises consisting of three engine-dynamos of 300 kilowatts, total capacity, connected by the Arnold system. The units are composed of Ball engines and Western Electric dynamos. The Mutual Electric company is also wiring the new Chicago, Burlington and Quincy passenger station at Quincy, Ill., and the Great Western car shops at Oelwein, Ia. The latter will have a 400 horse power plant for power, arc and incandescent lighting.

A majority of the directors of the John Stephenson company of New York, a car-building corporation, having applied to the Supreme Court for a voluntary dissolution of the corporation, Justice Cohen, on October 24th, appointed James M. Varnum of New York as referee for the purpose, and December 6, 1898, as the date of the hearing. Pending the application, Albert A. Wilcox of Paterson, N. J., and Louis Stern of New York were appointed temporary receivers of the property of the company to complete the contracts in process of execution. The receivers were required to give a bond for $100,000. The business of the company was an old one, as from the original shops the first horse car built in the United States was turned out in 1831. A New York financial paper says that the assets are placed at $1,175,776, and the liabilities $788,782.

BUSINESS.

The Western Electric company has in stock a large and complete assortment of weatherproof sockets and receptacles for Thomson-Houston, Edison and Westinghouse bases. Orders for material of this kind will receive prompt attention.

The Buckeye Electric company, through J. H. Cooke, its Chicago and western representative, reports a lively fusillade of orders for the Buckeye special coiled-filament lamps. The "Buckeye" is known to every user as a lamp of continuing value. Catalogues and price-lists are sent on application.

Within the last few months the Missouri-Edison Electric company of St. Louis, Mo., has placed 700 General Electric single-globe enclosed arc lamps upon its alternating-current circuits. These lamps are used for interior illumination and are said to be giving very satisfactory service. They replaced 18-ampere, 30-volt, open-arc alternating lamps.

The Electric Appliance company is meeting with great success in the sale of its combination fuse block and lightning arrester for telephone work. The device seems to fill a large demand for an efficient device for protecting telephone apparatus, and the Electric Appliance company has yet to hear of a single case where it has failed to operate in an entirely satisfactory manner.

The Stow Manufacturing company of Binghamton, N. Y., reports a most excellent business for the year thus far, particularly for its combination of flexible shaft and ironclad electric motor. The increase in its home trade has been large, and the foreign demand has far exceeded the company's expectations. The Stow company has recently made some noticeable improvements in its ironclad motors, and believes that they are not excelled by any other motor on the market in efficiency, simplicity and durability.

The William Inglis Wire and Iron Works, Detroit, Mich., have placed on the market an incandescent-lamp guard, which it claims to be the most convenient, firmest and best. It is called the "Improved Perfection" incandescent-lamp guard, which opens so that the lamp can be handled without detaching the guard from the socket. The company has been in the business for some years and has met with considerable success. A circular giving full information regarding the lamp guard will be cheerfully mailed to any interested person, on request.

The Chicago Fuse Wire and Manufacturing company, Chicago, reports that it is doing a larger business than ever before and that orders are coming in with increasing rapidity. As is well known, this company manufactures fuses for ceiling rosettes, branch blocks, Thomson-Houston railway fuses and like specialties, which have made the company known all over the country. W. R. Goodman, the energetic manager of the company, has recently secured some large orders, and the prospects for a large fall and winter trade are exceptionally good.

The Warren alternating-current apparatus manufactured in Sandusky Ohio, being of the inductor type and constructed on the latest and most improved lines known in dynamo designing, has gained its high reputation upon its merits. Among these, as claimed, are absolutely perfect electrical and mechanical construction and workmanship, highest efficiency, close regulation, no continual expense for repairs, cool, steady and noiseless running, and last, but not least, peculiar simplicity. The Western Electrical Supply company of St. Louis, Mo., is the general sales agent for this apparatus.

A new company, the Diamond Meter company of Peoria, Ill., announces that it has purchased all of the machinery, stock and material of the Diamond Electric company, and will continue the manufacture of the Scheeffer wattmeters and Scheeffer transformers, with the aim to retain the quality and high efficiency heretofore enjoyed by these goods. The new company states that it has no connection whatever with the Diamond Electric company and no Chicago office, hence all correspondence should be addressed to Peoria, Ill., as it does not get the mail of the Diamond Electric company. Any orders recently sent them should be repeated to the new company to receive proper attention. As far as has been decided, although no officers have as yet been elected, the organization of the Diamond Meter company will consist of E. H. Couch as president, A. B. Fink as secretary and manager, W. H. Hyle treasurer, G. A. Scheeffer electrical engineer and superintendent, thus practically effecting an entirely new organization. Messrs. Couch and Hyle are of the firm Couch & Hyle, hardware dealers in Peoria, and A. B. Fink, secretary, is also a prominent Peoria business man. Mr. Scheeffer, the electrical engineer of the new organization, is well known for his high scientific attainments and his skillful experience in the development of Scheeffer meters. With this new and satisfactory organization and excellent financial

backing, aided by Mr. Scheeffer's experience in technical matters, it is safe to say that the new company's prospects are of the best.

The many friends of the enterprising firm of Cass & Aaron, Chicago, that has been for the last year handling new and second-hand dynamos and motors and doing general repair work in the West, will be interested to know that the business name has been changed to the Cass & Aaron company. The organization of the new institution now consists of Jacob Aaron as president, R. Spaldsbury treasurer, and Philip Cass secretary. Mr. Cass stated that it had recently been decided to form the stock company and that the capitalization was $10,000. He further said that the company really had more business than it could well handle without the increased capital and that prospects were exceptionally good. The Cass & Aaron company besides doing a very nice repair business makes a specialty of handling second-hand machinery. In fact, this latter branch is one of the most extensive of the company's business, and one which it is fostering to the greatest extent. President Aaron under the new organization will continue to take charge of the mechanical work of the institution, while Mr. Spaldsbury will look after the finances. Mr. Cass will continue his successful work of attending to the outside interests of the company, and it may be said that the present success of the institution is largely due to his skill in securing new business.

ILLUSTRATED ELECTRICAL PATENT RECORD.

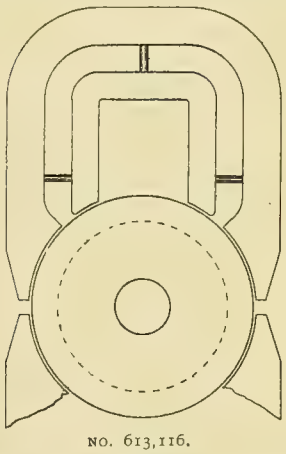
Issued October 25, 1898.

612,880. Electric Contact Box. Joseph N. Thomas and William M. Brown, Johnstown, Pa. Application filed March 22, 1898.

A sealed vessel of insulating material contains the switching mechanism, an electrode is fixed inside the top with a metallic cap covering it, a metallic sheath for the top walls of the vessel, and an electric conductor passing through the top of the vessel and secured to the sheath and to the cap.

612,885. Annunciator. Oscar Wiederhold, Summit, N. J. Application filed October 2, 1897.

An annunciator is described comprising in its construction a plurality of swinging armatures adapted to be acted upon by a magnet pole, a diamagnetic cap adapted to cover the magnet pole and to prevent the armature from contacting therewith and provided with a plurality of stops for limiting the movement of the armatures in a reverse direction.



NO. 613,116.

612,929. Insulator and Hanger for Electric Railways. Willie C. Keithly, San Francisco, Cal. Application filed January 26, 1898.

An insulator and hanger for electric railways consists of a hollow cap in the form of a frustum of a cone having interior lugs, a correspondingly shaped hollow insulator with exterior lugs adapted to engage those of the cap, the insulator having a less diameter than the interior of the cap and a filling of insulating compound surrounding the insulator within the channel thus formed.

612,943. Electric Furnace. Louis Bresson, Lyons, France. Application filed February 8, 1898.

This furnace has an oscillating crucible with means for operating it, carbon electrodes isolated from the body of the furnace and projecting into the crucible, and means for supporting the electrodes, and for raising their extremities without changing the length of the arc.

612,977. Armature Winding. Andrew L. Riker, New York, N. Y. Original application filed November 19, 1897. Divided, and this application filed April 18, 1898.

A coil for armature windings is composed of a number of turns of round wire forming a hexagonal figure having two straight parallel sides to occupy slots in the armature core, connecting parts in substantially the same plane as the sides, and a downward bend at each end of the coil, the latter being of a thickness of two wires across the bend, and of one wire elsewhere.

612,999. Electric-lamp Guard. Herman M. Underwood, Chicago, Ill. Application filed August 19, 1897.

The essential features comprise a base ring around the lamp, a spring clamp having one end attached to the base ring, and the other end adapted to yieldingly receive the bulb socket of the lamp, wires disposed to form a two-part guard around the main outer portion of the glass bulb of the lamp, and each of such two parts pivotally attached to the base ring, and adapted to swing outwardly in opposite directions and to swing inwardly to form the guard.

613,036. Telephone-exchange System. Charles S. Heilman, Philadelphia, Pa. Application filed November 21, 1896.

The signal mechanism is arranged in a branch of the main line, a movable coupling plug is arranged in another branch of the main line, and a switch which is arranged in the signal mechanism branch, but which is not electrically connected with the plug, is operated to open the signal mechanism branch upon withdrawing the plug and to close the signal mechanism branch upon returning the plug.

613,046. Automatic Leak or Ground Cut-out. Walter L. Pratt, Adams, N. Y. Application filed May 20, 1896.

An automatic leak cut-out comprises a hinged arm carrying loop connections, the arm being held normally in circuit by a fuse wire with a branch circuit to ground, condensers included in the branch circuit, a magnet and an armature adapted to fuse the fuse wire when the leakage of current has sufficiently accumulated in the condensers so that a discharge to ground would occur.

613,054. Electric Fan. Daniel L. Bates and Russell H. Bates, Dayton, Ohio. Application filed July 21, 1898.

There is the combination with a central-motor support of a sleeve or tubular support for the armature, fan blades and commutator, the sleeve or armature support surrounding the motor support and providing a bearing for the armature and fan blades substantially the length of the motor support, a combined oil cup and fan blade support attached to the upper end of the sleeve, and a stationary oil cup at the lower end of the sleeve in which the latter has a bearing.

613,116. Dynamo-electric Machine or Motor. Sidney G. Brown, London, England. Application filed April 9, 1898.

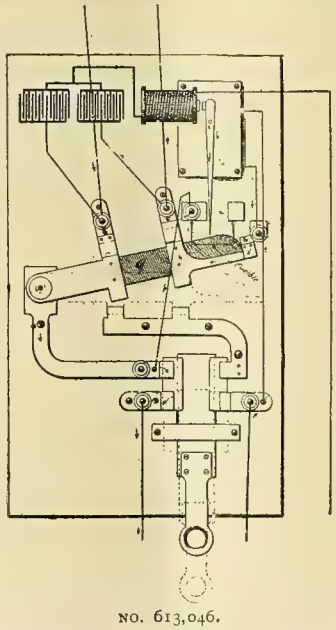
In a field magnet for a dynamo or motor, the combination is described of an outer portion having an extended pole face, an inner portion magnetically distinct from the outer portion and having a contracted pole face, and means for exciting the two portions.

613,128. Electric Switch. William Ely, Providence, R. I. Application filed September 5, 1896.

Contact parts are carried by the shaft, and a crank or arm is secured upon the shaft. Means for imparting initial movement to the crank and shaft in one direction only consists of a lever pivoted at one end and a pawl pivoted at one end to the pivoted end of the lever and adapted with its free end to releasably engage with the free end of the crank and other means for completing with accelerated movement the rotation of the crank and shaft.

613,129. Electric Switch. William Ely, Providence, and Walter B. Bernardini, Lakewood, R. I. Application filed July 29, 1896.

Contact posts are arranged in pairs or series, and knives or arms are carried by a rotatable shaft for connecting the posts in pairs or series, an internally recessed arm extending at right angles from the shaft and loosely pivoted thereon and adapted to be partially rotated thereon without reference to the movement of the shaft, a stationary guideway, a crosshead adapted to reciprocate in the guideway, a link pivoted to the arm and crosshead and connecting the two, a crank arm rigidly secured to the shaft and extending at right angles therefrom and angularly inclined relatively to the loose arm, and adapted to be actuated thereby, an extensible spring connecting the free end of the crank arm with the crosshead, and means for actuating the loose arm, all combined with each other and with a rotatable shaft.



NO. 613,046.

613,135. Alternating-current Electric Motor. Anthony S. Frazer, Tynemouth, England. Application filed December 28, 1897. Patented in England March 11, 1896, and in France April 1, 1897.

An alternating electric motor is described comprising a stator and rotor with a commutator consisting of one cylinder concentrically within the same, two pairs of brushes arranged for contact with the segments of the commutator, a series of alternately reversed windings on the rotor, corresponding to the segments, the coils of the stator relatively reversed for bipolarity, circuit connections to the windings and brushes of the rotor, short-circuit connections for the coils of the stator and shunt-circuit connections thereto from the main circuit, the arrangement of the parts being such that a monophase current will produce a progressive or traveling polarity of the rotor by the contact of the sets of brushes with the commutator.

613,175. Underground Electric-railway System. Fred D. Robb, Hot Springs, Ark. Application filed July 2, 1897.

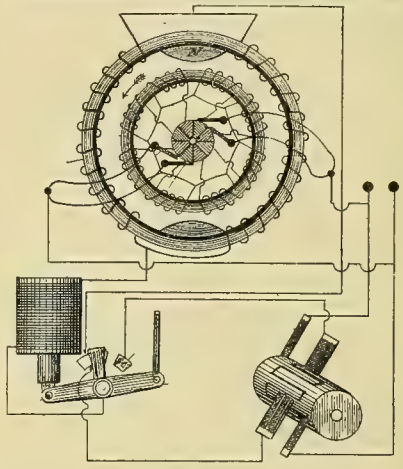
A conduit comprising a sectional casing is provided with means for uniting the sections of the casing, each of the sections having one of the sides of the curved body portion cut out longitudinally entirely through the same below and communicating with an upper trolley slot, and a curved hinged door adapted to close or open the space formed in the cut-out portion.

613,181. Trolley Pole. John Walsh, Elyria, Ohio. Application filed November 2, 1896.

The pivoted trolley pole is provided at its upper end with a crosshead having guides, a sliding rod situated within the guides and incapable of axial rotation, and a rotatable trolley wheel situated about midway between the end of the rod and through which the rod extends and which is incapable of longitudinal movement thereon.

613,203. Alternating-current Motor System and Method of Operating Same. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed April 10, 1897. Patented in France September 12, 1896.

This method of starting a single-phase alternating-current motor of the induction type consists in opposing progressively varying electromotive forces to the electromotive forces existing in the circuits of the windings of its induced member so as to create therein a rotary field.



NO. 613,135.

613,204. Alternating-current Asynchronous Machine. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed May 4, 1897. Patented in France July 20, 1895; in England August 16, 1895; in Italy August 26, 1895; in Belgium August 27, 1895; in Hungary August 30, 1895; in Spain September 9, 1895, and in Switzerland November 29, 1895.

An alternating-current dynamo-electric induction machine is described in combination with an independently driven dynamo electric source of current supply for charging its induced member with exciting currents having the frequency of the slip, whereby wattless currents for the excitation of the machine are dispensed with on the line.

613,205. Electric-current Leveler. Maurice Hutin, and Maurice Leblanc, Paris, France. Application filed December 16, 1897. Patented in France November 27, 1894; in Belgium December 6, 1894; in Italy December 10, 1894; in Germany December 11, 1894; in Switzerland December 22, 1894; in Hungary January 5, 1895; in Austria January 11, 1895, and in Spain February 7, 1895.

As a means for reducing the alternating component of a complex current wave flowing in an electric circuit, a transformer is provided with a primary in series with the circuit, and with a short-circuited high-resistance secondary in inductive relation to the primary.

613,206. Method of and Means for Synchronizing. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed December 30, 1897. Patented in France February 9, 1897; in Austria February 23, 1897; in Belgium July 24, 1897; in Switzerland July 24, 1897, and in Italy July 29, 1897.

The method of synchronizing two or more alternate current dynamo-electric machines, electrically connected together, consists in varying an extra load on one or more of these machines, by and in accordance with any departure from synchronism.

613,209. Alternating-current Dynamo-electric Machine. Maurice Leblanc, Paris, France. Application filed April 10, 1897. Patented in France May 17, 1889; in Germany June 9, 1889; in Austria August 10, 1889; in Hungary August 10, 1889; in Switzerland December 2, 1889; in England December 3, 1889; in Belgium December 7, 1889; in Italy December 12, 1889.

The method of maintaining synchronous relative speed between the rotor and the field-poles of the stator of a single-phase alternating current motor at all speeds of the rotor, consists in rotating the polar line of the stator from moment to moment by currents conveyed therefrom or thereto, so as to maintain a sensibly constant angular displacement between the polar line of the stator and the polar line of the rotor.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, NOVEMBER 12, 1898. No. 20

Charles H. Summers.

The sudden death of Charles H. Summers, the chief electrician of the western division of the Western Union Telegraph company, removes a man who took an active and honorable part in the electrical development of his time, particularly in the improvement of the art of telegraphy, but also, to a considerable extent, in the introduction of the electric light and the telephone and in the study of inductive effects. Mr. Summers possessed an active, wideawake intelligence and the taste and talent for research. He had an open and receptive mind and gave every man a fair hearing. He demanded, nevertheless, that new theories, new projects, new inventions be put to the severest test before acceptance, but he was always willing to encourage the test, was interested in it, and perhaps offered to assist. He was progressive, but clear-headed and without illusions. For the last 10 years Mr. Summers had not been so active in electrical study and research, owing to the state of his health, but the older electrical men will willingly bear tribute to the value of his work. In private life he was highly esteemed, and in his long connection with the Western Union Telegraph company had endeared himself to its officers. He had a wide acquaintance among the leading men of the country, particularly in the telegraph and telephone industries, and his cheerful disposition made him ever a welcome guest.

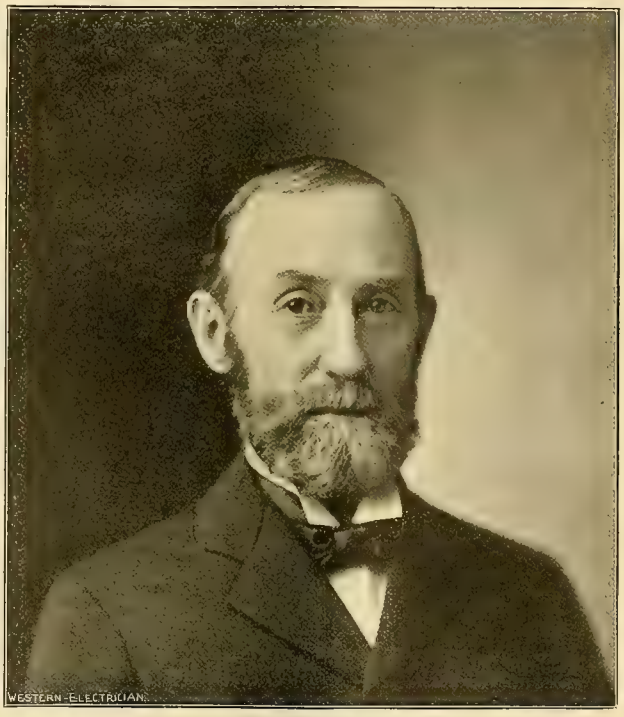
For 30 years Mr. Summers had his office and his home in Chicago, but he died in San Francisco on November 2d. He left Chicago on a leisurely business trip on October 24th in good spirits and comparatively good health. In San Francisco, on the evening of his death, he dined with Mr. D. R. Davies, the assistant superintendent of construction of the Western Union company at San Francisco. After dinner he and Mr. Davies went to the Palace Hotel, where they engaged in conversation for some time. Afterward Mr. Summers proposed a walk. While they were walking, at about 10:45 p. m., Mr. Summers complained of sudden illness. Mr. Davies supported his friend to a lodging-house in the vicinity and summoned a physician. But before the physician arrived Mr. Summers expired, very peacefully and without pain. The physician stated that death was due to inflammation of the heart.

Charles H. Summers was born in Fleming County, Kentucky, on July 6, 1837. His ancestors were Virginians, dating back to 1609. He was but a boy when he entered the telegraph service in 1854, as an operator on the old Pittsburg, Cincinnati and Louisville line, built over the highway from Pittsburg to Louisville, of which James D. Reid was superintendent. After this line was consolidated with the Western Union Telegraph company, he worked at different points as an operator, and, in 1859, while working at Indianapolis, was offered and accepted a good position on the railroad lines. Indianapolis was his headquarters until 1867, when he was made superintendent of telegraph of the Indianapolis, Cincinnati and Lafayette railroad telegraph lines and located at Cincinnati. In 1869 he was called to Chicago as chief electrician of the western division of the Western Union Telegraph company by General Anson Stager. He remained in the service of the company as electrician from that time until his death.

Mr. Summers was twice married. His first wife was Miss Emma Porter, to whom he was united in 1859 at Ripley, Ohio. Mrs. Summers died in 1873, and several years later Mr. Summers was married to Miss Anna Porter, who survives him. There are seven children—Misses Florence, Maud and Neva Summers of Chicago, Mrs. A. W. Towsley of Roanoke, Va., and Leland L., Bertrand S. and Ray P. Summers of this city. Mr. L. L. Summers was formerly with his father as assistant electrician of the Western Union company. Later he was connected with the Postal Telegraph company as electrician of the western division. Since 1894 he has maintained an office in Chicago as a consulting engineer. Mr. B. S. Summers is the chief chemist of the Western Electric company, while the youngest son is still at school.

Mr. Summers' early connection with electrical science made him a pioneer in many lines which were subsequently developed into commercial enterprises. It is difficult to tell just how much his personality had been impressed upon some of the most important developments of electrical industry. There are many anecdotes related of his early experiences.

In the development of the duplex, when Mr. Stearns was trying his first experiments between Chicago and Detroit and Toronto, it was found that the instrument would not successfully record the signals. Much time was spent in endeavoring to find the trouble, and finally Mr. Summers suggested that a telegraph line acted like a wet string or a Leyden jar, and that in his opinion the experimenters could never duplicate the conditions of the line unless some Leyden-jar effect was put on the artificial line. This was perhaps the first suggestion for using a condenser in the artificial line, and enabled duplex telegraphy to become a possibility. Ocean cabling was doubled in capacity on this principle, and indeed it was the suit over duplex cabling that brought out Mr. Summers' early connection with the application of the condenser. Efforts were made to persuade Mr. Summers to go to London and take the witness stand in the law-



CHARLES H. SUMMERS.

suit over the invention, but, as was characteristic of him, he maintained that it was none of his concern.

The first incandescent-lamp plant installed in Chicago was installed by Mr. Summers in the old grocery store of Charles H. Slack. Swan lamps were brought from England for this purpose.

When the telephone first came out, the first two sets of instruments brought to the West were taken to Mr. Summers' office by Mr. Gardiner G. Hubbard, Alexander Graham Bell's father-in-law. Mr. Hubbard tried to persuade Mr. Summers that the telephone was a coming feature of commercial business, and although the instruments were very crude and very cumbersome, Mr. Summers instructed that wires be assigned for experiments, to test the practicability of the instrument. This early telephone was about the size of a moderate traveling trunk, with a large mouth-piece placed in one end of the box. At that time Mr. Summers was living about 25 miles north of Chicago, in one of the suburbs, and experiments were made between his house and his office. The offices of the Department of the Missouri of the United States Army were in the Western Union building, and General Phil Sheridan, the commander, had his office next to that of Mr. Summers. One morning while some of Mr. Summers' assistants were yelling at the top of their voices, endeavoring to "raise" Mr. Summers at his house, General Sheridan opened the door and wanted to know what in—something or other—all the riot was about. When told that they were trying to call Mr. Summers up 25 miles away, he remarked drily that it had been tried at shorter distances without effect. It was explained to the general that the noisy young men could do it electrically. He became much interested, though still skeptical, as Mr. Summers' propensity for scientific joking was known to him by experimental knowledge. Finally, to his amazement, he heard Mr. Summers' voice, and although it was familiar he refused to accept it until he had a favorite old southern song sung to him by Mr. Summers. General Sheridan became a firm believer in the possibilities of the telephone and spent the rest of the forenoon amusing himself with the instrument, with Mr. Summers at the other end. This was one of the earliest experiments with the telephone. Even at this time the telephone was not a novelty to Mr. Summers, for Professor Elisha Gray had made a number of experiments in musical telephony, and Mr. Summers' house had been a laboratory for experimenting on the Western Union wires.

When the overland railroad was completed to California, in the early seventies, telegraph lines were strung along the railroad. Mr. Summers was an early traveler over the new route and took a trip on the cow-catcher of the locomotive, inspecting the telegraph wires. He used to recount his amazement at the way the telegraph poles were absolutely broken down and worn through by the huge herd of buffalo using them as a means of scratching their backs.

When the route was completed to San Francisco and efforts were made to work the lines through without numerous relays, it was found that even when the telegraph wires were open they behaved almost as if they were grounded. This was a puzzling condition to all the electrical staff of the Western Union, and very heated arguments resulted as to whether there were leaks, whether the fault was due to poor construction or whether the cause should be sought in some other direction. Mr. Summers remembered his wet-string experiments, however, with the early duplex, and maintained that the effect was simply due to the static capacity of the line. He also maintained that this effect could be compensated for by paralelling wires and causing an induction from one to the other, or by inserting certain forms of induction coil. Mr. C. H. Wilson in that year patented a method for compensating by means of induction coils.

These early researches of Mr. Summers in static capacity, mutual induction and compensation of static capacity by self-induction were the first experiments in the field of American alternating-current work. It was no surprise to him to see the development of the alternating current, as he had long been an advocate of the possibilities of utilizing inductive devices for transforming electrical current. He was an enthusiastic admirer of Dr. Heinrich Hertz, the great German physicist, and looked upon resonance and the tuning of electrical circuits by means of capacity and inductance as but a natural development of the field in which he himself had been an early pioneer.

Notwithstanding Mr. Summers' early connection with these developments of electrical science, there is no record in the Patent Office that he ever filed an application on an invention. He was essentially of a scientific turn of mind and he also came from an old southern family, and inherited the chivalry of the southern gentleman. A struggling inventor coming to Mr. Summers' office was listened to attentively and given an opportunity to explain his invention. He instinctively felt there was no danger of piracy of his invention, but, on the contrary, he had the benefit of Mr. Summers' judgment and the assistance which Mr. Summers' position and authority enabled him to give. Mr. Summers' assistants in his office were often highly amused at the work they were sometimes detailed upon, investigating the whim of some inventor who had succeeded in reaching Mr. Summers with his invention.

Mr. Summers, with his scientific mind, was a born skeptic in everything and admitted no authority but that of proof, and the possibilities of research. The ægis of a name had no terrors for him, and he was indifferent to the authority for a given statement until it could be demonstrated to his own satisfaction. This trait in his character enabled many men

to get their first assistance from him in some of the inventions which have since been developed into commercial enterprises. To anyone having an idea or invention of merit Mr. Summers readily tendered his assistance, and the wires of the Western Union Telegraph company were often used to test the theories advanced.

Mr. Summers delved in many lines of scientific thought and he was well known as an early investigator in psychical research. He had visited prominent experimenters in almost every part of the country, and had many amusing incidents to relate. In the early days it had been a joy to investigate with newspaper men, and he was known as a man ever ready to accompany a newspaper man on an investigating tour in the psychical line. Notwithstanding the fact that he had been identified with many exposures of fraudulent "mediums," he always maintained that telepathy or thought transferrence was a possibility.

He believed with Crookes in the possibilities of vibrations of space, which we are not familiar with as yet, and along this line believed there would be developed a system of communication without wires or other physical means of connection. In his studies of Hertz he was very much impressed with the possibility of developing electrical vibrations which were different from those usually employed in electrical work. He believed it would be possible to generate electricity direct from coal or heat, and believed absolutely that from the wave theories would be found a means of transforming the different manifestations of energy from one form to another.

He was known to lend an attentive ear to any inventor who had suggestions to make upon the generation of electricity from heat, and he and his assistants had often made tests of old stoves in various forms which were the dreams of speculative inventors.

His jovial and genial disposition made him many friends and very warm ones. His mind was very alert and almost intuitive, and inclined far more to the original speculative turn than to purely deductive methods. He was musical and also a poet of some ability. He had never published any of his verses except in scattered magazines and those which found their way into the newspapers through some interested friends, but during the later years of his life there was seldom a festive occasion or matter of moment without a poetical expression from his facile pen. His poems circulated quite freely among his intimate friends and were highly prized.

In his long connection with the telegraph service Mr. Summers had visited every part of the United States, much of Mexico and of Canada. His adventures in the South and West would fill a volume. He had faced death many times. His thrilling adventure on the Mexican border, though serious enough, was the cause of much joking to his friends. In 1880, when inspecting the telegraph lines along the Rio Grande border, he happened to fall into company with the sheriff of the county, who was accompanied by two deputies. The sheriff had met Mr. Summers at a prominent judge's house and was glad to have his company as they traveled along in the saddle. This little jaunt ended in a hand-to-hand combat with a gang of desperadoes who had recognized the sheriff. Of this party the sheriff and Mr. Summers were the only ones that escaped death, the other four members of the party being killed on the spot. Mr. Summers was shot in the back, but nevertheless he made an enviable reputation on the border by being quicker with his gun than the leader of the desperadoes. He was said at the time to have been the only man who ever "had the drop" on this desperado. The electrician was censured by the sheriff because he had calmly disarmed his man by taking from him the brace of revolvers he carried and then ordered him to run. The sheriff was Breto, well known in Brownsville and very intimately known along the border for his ability with the gun. Of the desperadoes none got away but Mr. Summers' antagonist, Sheriff Breto attending to the others in characteristic frontier style.

Upon Mr. Summers' return to Chicago he found that his suite of offices had been turned into an arsenal. Friends from all parts of the United States had thoughtfully forwarded all forms of firearms and weapons procurable. Everything was present, from a brass cannon to tin swords and toy pistols.

For the last 10 years Mr. Summers had been more or less an invalid. His poor health was caused by an accident in the line of his engineering duties. One of the first commercial underground systems of the country was installed for the Western Union company by Mr. Summers. The connection for this system with the main office in Chicago had been made through a large underground tunnel. When the connection had been made Mr. Summers, accompanied by the constructing engineers, started into the tunnel to make an inspection. Illuminating gas had entered through a leak in a gas-main, and when the party had gotten well inside the tunnel there was a terrific explosion. A number of the party were blown out of the tunnel, but Mr. Summers was dashed against the walls and was carried out unconscious and badly burned. For a long time his life was despaired of, but his vitality enabled him to pull through and he was able to attend to his duties within a year. The effects of this accident were never overcome, and a weakened heart action and shattered system resulted.

He had taken marked care of himself for two or three years previous to his death, and during the last summer he expressed himself as feeling much better than for some time. His California trip evidently proved too much for him, and his sudden death was caused by an unexpected attack of the old heart trouble. Though a long way from his family at the time of his death Mr. Summers could not be in any part of the western country and not be among friends, and, though sudden, his death was in every way as he would have wished it, as he had often expressed himself as wishing to die without a lingering illness. He was without fear of death, and had faced it too many times not to realize what it meant.

The funeral services were held on Tuesday afternoon at Mr. Summers' late residence, 661 Fullerton avenue. Rev. Jenkins Lloyd Jones delivered a touching address, during which he read two of Mr. Summers' poems very effectively. The tribute of flowers was beautiful and extensive. Among the large number of electrical men in attendance were the following-named officers of the Western Union Telegraph company: R. C. Clowry, vice-president, Chicago; F. H. Tubbs, district superintendent, Chicago; J. J. Dickey, district superintendent, Omaha; T. P. Cook, district superintendent, St. Louis; I. McMichael, district superintendent, Minneapolis; W. J. Lloyd, assistant district superintendent, Chicago; F. R. Steele, manager, San Francisco; E. M. Mulford, manager, Chicago; C. H. Bristol, superintendent of construction, Chicago; V. T. Kissinger, H. E. Roberts, J. F. Morgan, F. J. Scherrer, L. J. Amsden, Chicago. Others present were E. P. Wright, Cleveland; U. J. Fry, Milwaukee; E. M. Barton and George L. Beetle, Western Electric company, Chicago; L. D. Parker, general superintendent Postal Telegraph company, Chicago; J. E. Zeublin, general superintendent Chicago Telephone company; W. S. Chapman, secretary Central Union Telephone company, Chicago; P. W. Drew, Milwaukee; F. J. Loesch, W. W. Ryder, J. S. Evans, J. S. Barclay and W. E. Bell.

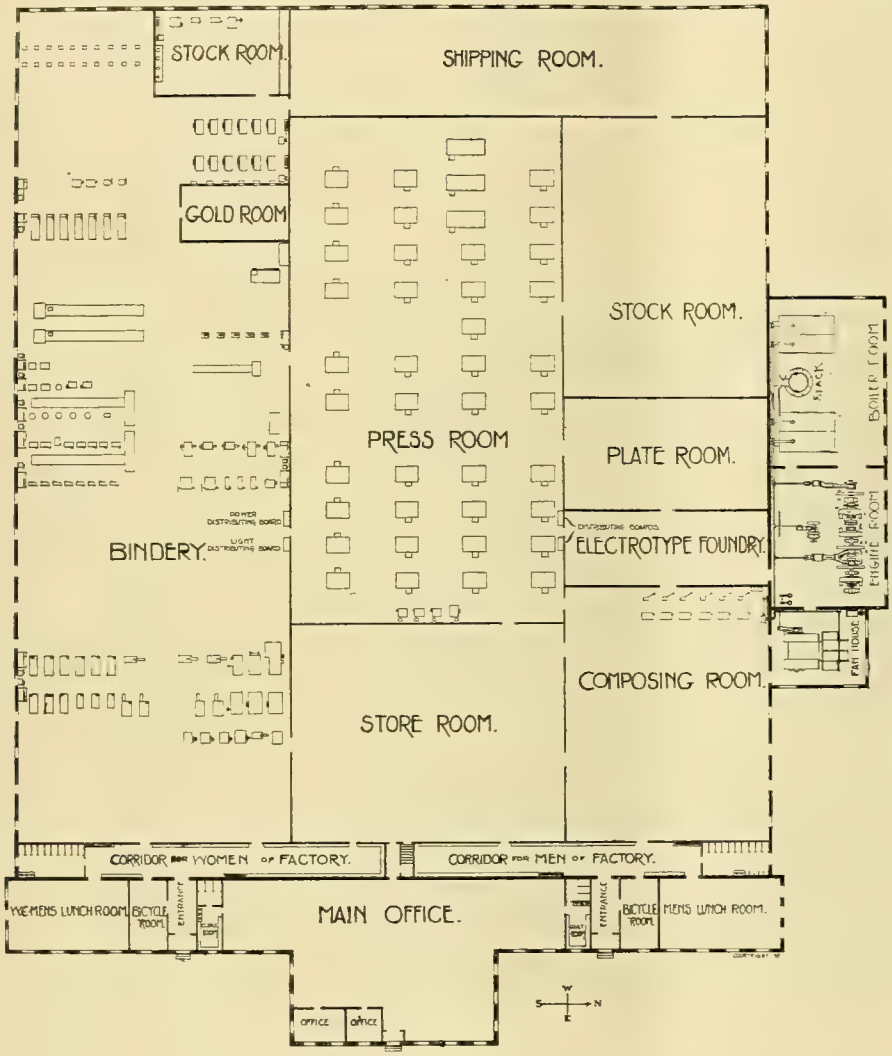


Fig. 1. Plan of Building.

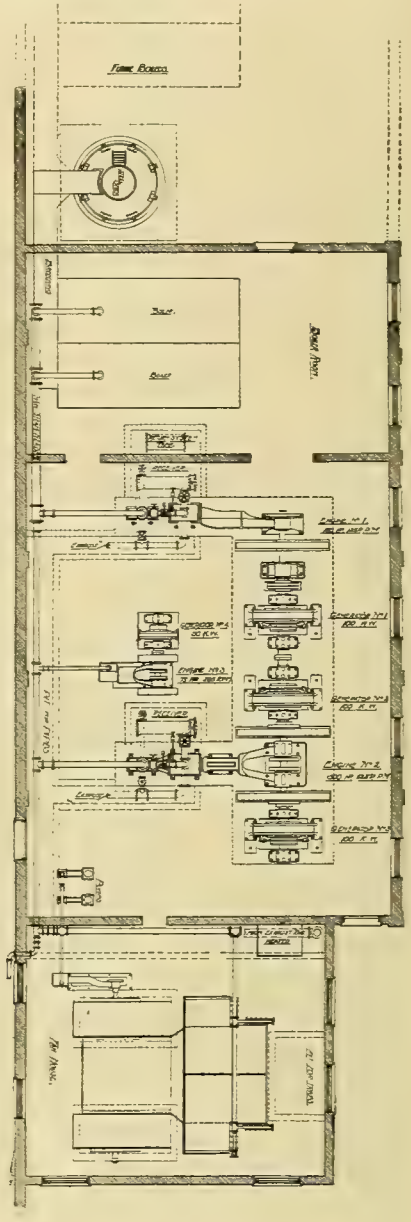


Fig. 2. Power Plant.

ELECTRICAL EQUIPMENT OF A MODEL PRINTING ESTABLISHMENT.

Electrical Equipment of a Model Printing Establishment.[1]

By George A. Damon.

To even a casual observer the part which electricity is playing in industrial movements is an interesting study. The concentration of great manufacturing establishments about water powers and the opening up of vast suburban districts about our cities by means of the rapidly moving electric car are everyday instances of the influence of electrical development upon constantly changing industrial conditions. Perhaps less evident, but none the less important, are the changes which are being brought about by the use of the electric motor in the operation of manufacturing establishments. Enterprising manufacturers have not been slow in appreciating the advantages to be gained by the electrical operation of their factories, and we have many instances where the cost of labor and of power has been reduced, or the efficiency of a process has been increased, by the use of the electric motor.

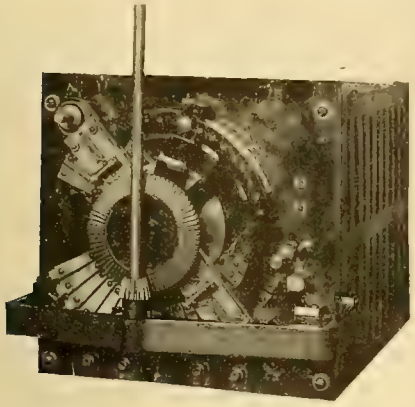


Fig. 4. Controller.

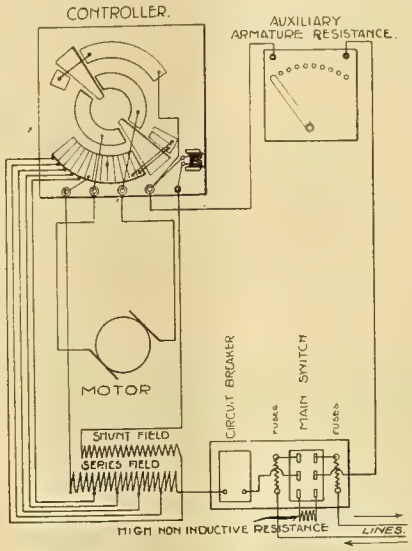


Fig. 5. Diagram of Controller Connections.

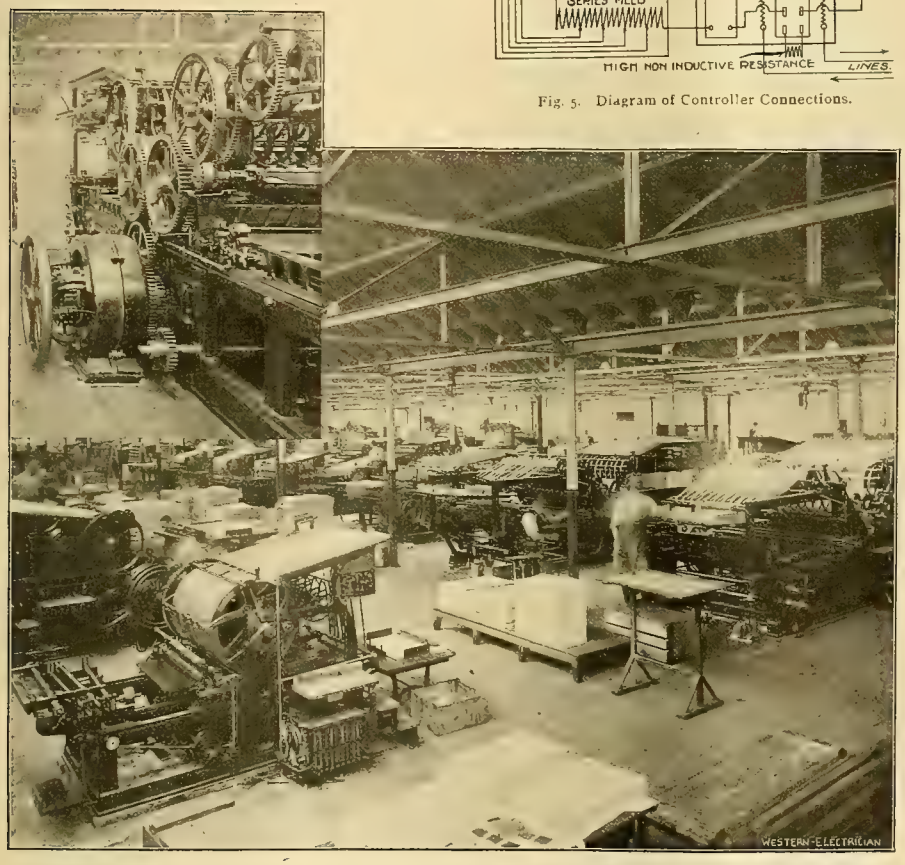


Fig. 3. Press Room, showing Motors and Controllers.

ELECTRICAL EQUIPMENT OF A MODEL PRINTING ESTABLISHMENT.

There are few instances, however, where the adoption of electric power has led to such a radical departure from ordinary methods, or where greater advantage has been taken of the possibilities of electrical operation, than in the model printing establishment of the W. B. Conkey company at Hammond, Ind. This great establishment is the result of more than 20 years' development. Starting with a small capital, Mr. Conkey gradually increased the size of his establishment until, about a year ago, it occupied the seven-story Franklin building, on Dearborn street, Chicago, and two seven-story structures on Plymouth place, besides a large warehouse on Market street. While quite as successful as many other publishing houses, the operation of this immense plant in the center of a great city presented many disadvantages. Taxes were necessarily high, insurance rates oppressive and the cartage of raw material and finished product to and from the depots through a congested business district was slow and expensive, while its movement by the railroads was unsatisfactory. The mill construction of the buildings, their location with respect to surrounding structures and the extent of floor space employed made it necessary to supply artificial illumination to many parts of the factory during the entire period of operation. The relative location of the buildings made it necessary to maintain two distinct plants for power, heat and light. Power was transmitted from the engine flywheel to the various machines by means of belts, rope drives and pulleys. By actual tests fully 45 per cent. of the power delivered by the engine to the main driving shaft, at average load, was used to run the shafting, and this transmission loss was, of course, much larger at lighter loads.

A consideration of these disadvantages led the company to seek a new location with more advantageous conditions. A flattering bonus offer from Hammond, Ind., made it possible to secure a factory site with ample room and shipping facilities, and as a result the most extensive buildings for the purpose in the country have been erected and equipped there. Hammond is practically a suburb of Chicago, being connected to it by an electric road and six lines of steam railways. The belt line makes direct connection with 14 trunk lines centering in Chicago. A special car leaving Chicago every night delivers small local freight upon the shipping platform of the plant at Hammond every morning. With the same freight rates as formerly, it has been found that the cost and time of handling shipments have been materially reduced in the new location.

The plant is located on a stretch of rolling prairie land, and the buildings cover about [illegible] acres of ground space. A macadamized roadway extends along two sides of the main buildings, while an extensive park, containing artificial lakes, rare shrubbery and artistic flower beds, has been laid out before the main entrance. Hundreds of employes spend their noon hour upon the big playgrounds which surround the factory or wander in the woodland near at hand. But the most unique feature of the plant is the construction of the building. It extends over an area of 520 by 450 feet and consists of but one floor. This makes it possible to pay especial attention to the lighting, and, as a result, the whole roof resembles a vast skylight. The windows of the roof are glazed with frosted glass and are placed at an angle looking toward the north. Every 29 feet of floor space provides 11 feet of light. Owing to the angle of the roof the direct rays of sun are kept out of the building, which is thus lighted by the soft, reflected rays from the northern sky. It would be hard to conceive of a more evenly or more thoroughly lighted factory building. The entire roof is built up of light structural steelwork resting upon cast-iron columns spaced on 29-foot centers one way and 16-foot centers in the other direction. The height of the trusses above the floor is 12 feet. A very good idea of the appearance of the inside of the building is given by Figs. 3 and 6.

The general plan of the plant is shown by Fig. 1. The general and private offices, with the employes' dining, bicycle and wash rooms, are located at the front of the building. The press room occupies a space 116 by 212 feet in the center of the large structure. The receiving room and shipping room are conveniently located in relation to the side track platform, while the plate vault, electrotype room, composing room, store room and hard and soft bindery surround the central press room. It will thus be seen that the stock passes through the plant with a minimum amount of travel from the receiving platform to the shipping room. As everything is upon the ground floor, no elevators are required. The power plant, with its boiler, engine and fan room, is located on the north side of the building convenient to the railroad tracks. Coal is delivered from the cars directly into bins in the boiler room.

The arrangement of the power plant is shown in more detail in Fig. 2. The boilers are of the horizontal water-tube type with 3,472 square feet of heating surface and 60 square feet of grate surface per boiler. At the present time two boilers are installed, and the stack is situated so as eventually to be flanked on either side by two boilers of the completed battery of four. The breeching from the boilers to the stack is of sheet steel.

The stack is a self-supporting steel chimney 125 feet high and 54 inches diameter inside the gas flue. The courses for the first 30 feet from the top are made of three-sixteenths-inch plate, for the next 30 feet of one-fourth-inch plate, for the following 40 feet of five-sixteenths-inch plate, while the 25 feet coned base is made of three-eighths-inch plate. The stack is held in place by eight 1⅞-inch bolts bedded in a foundation of concrete. A unique feature of the stack is the method used of inverting each section so that the top end of each section rests outside the section immediately above it. This prevents the soot washing through the joints and down the outside of the stack, as is too frequently the case with steel chimneys.

The engine, shown upon the left end of the row of generating machinery, is an 11½-inch by 18-inch by 36-inch tandem compound non-condensing Corliss engine and runs at 125 revolutions per minute. This speed is rather high for a Corliss engine, but indicates the tendency of modern practice where the engine is directly connected to a generator. When properly designed there seems to be little reason why an engine with independent valves should not be run at this speed, and if successful at this number of revolutions per minute, we probably will not be satisfied until the speed is again raised. As long as the cost of electric generators of a given size increases in proportion as their speed is decreased, there will be great pressure brought to bear upon engine builders to produce a successful engine of the Corliss or similar type running faster than the ordinary 80 to 100 revolutions per minute. For purposes of power plants of this character the Corliss type of engine, in the minds of a great many engineers and purchasers, has advantages of economy in steam consumption and low cost of maintenance which engines of the high-speed type do not possess. The objection when directly connected to a generator is the cost of the unit.

This engine is fitted with double eccentrics and governors on both cylinders, the governor being of the Porter type. The special design of the double-ported admission valves permits a quick cut-off, while the operation of the steam and exhaust valves by separate eccentrics gives the engine a long range of cut-off and a large reserve capacity for overloads. The flywheel is made in halves, weighs 16,000 pounds, and is 12 feet in diameter, giving a peripheral speed of 4,700 feet per minute. With 120 pounds initial steam pressure and a back pressure of three pounds the engine is rated at 160 indicated horse power and is guaranteed to develop each indicated horse power hour on a consumption of 21 pounds of steam. It has an economical range of power between 100 indicated horse power and 225 indicated horse power, but is designed in all its parts to operate continuously on an overload of 100 per

1. Read before the Chicago Electrical association, November 4, 1898.

cent., or at 320 indicated horse power. Provision has been made in the piping to secure this overload by admitting high-pressure steam to the low-pressure cylinder. The conditions under which it may be expected to operate in this manner and at this unusual overload will be referred to later. The shaft of the engine is of open-hearth forged annealed steel. It projects through the outboard bearing a sufficient distance to carry a flange forged solid on the end of the shaft. This flange is to carry a coupling which connects the engine shaft to the generator shaft. Between the high and low-pressure cylinders and in a pit beneath the floor of the engine room is a receiver fitted with reheating coils and provided with the necessary traps for returning the condensed water to the boiler.

The generators are compound-wound and are designed to deliver 100 kilowatts output at 225 volts when running at 125 revolutions per minute. The field frame is split through the center on a horizontal plane, so that the upper part can be removed. This operation will not be necessary, however, in case repairs are required on the armature windings or field coils, as provision has been made to slide the entire armature frame parallel to the shaft, along cast-iron footings, a sufficient distance to clear the armature. The armature is of the ironclad type, with a commutator of ample proportions. The brushes are of carbon and the brush holders are carried in a circular iron frame arranged to be moved by means of a threaded rod and a hand wheel, so that the position of the brushes may be adjusted. The field frame has eight poles and the compounding coils are provided with an adjustable shunt, so that the over-compounding may be adjusted over a range of from one to five per cent.

The arrangement of the machinery in the power plant is shown in Fig. 2. It will be seen that this plan calls for two engines and three generators. The second engine is also a tandem compound, non-condensing engine, but is of the center-crank type with overhanging flywheels. This engine is of twice the horse power of the side-crank engine; that is, it can develop sufficient power to operate economically two of the 100-kilowatt generators, though when necessary it will be able to operate all three of the generators.

The whole line of machinery is connected on the "Arnold system" of power-station construction. In this system each generator armature is mounted in such a way as to be perfectly independent of the remaining machinery, and by means of a suitable coupling can be put in operation or thrown out of service, at will. The shaft upon which each generator armature is mounted is made hollow, so as to allow a solid shaft to be carried through it. This solid shaft is supported in two independent bearings near its middle and extends from engine to engine, but under normal operating conditions it is independent of the engines and of the generator shafts and lies idle in its bearings. Each end of this shaft is provided with a suitable coupling, so that it can be operated by either engine or by both working in unison. The result of this ingenious arrangement of shaft, hollow quills, bearings and couplings is that each generator can be operated by more than one engine. In a plant arranged with direct-connected units this feature is a decided additional advantage, for the units can be operated in much the same manner as in a belted plant. Ordinarily in a direct-connected plant the crippling of a generator will shut down its driving engine, or if an engine breaks down its contiguous generator must necessarily be taken out of service. The Arnold system obviates this disadvantage, and the result is that reliability is secured in the operation of the plant with much less reserve machinery than is ordinarily required. The arrangement may look complicated, but in reality it is simple, and for the advantages it secures it is comparatively inexpensive.

The method which has been adopted to provide for an increasing demand for power in this plant may prove of interest. At the present time engine No. 1 and generator No. 1 have been installed and are now handling the load. A smaller 50-kilowatt high-speed unit is being placed in position for the purpose of carrying the load when the press room is working all night. It may also be used to furnish current for the lighting circuits when the combined power and lighting load becomes too large for the Corliss engine and 100-kilowatt unit. Eventually, as the load is increased in size, engine No. 2 and the two additional generators will be installed, and the plant will then be ready to furnish economically all demands for power over a range of from 75 horse power to 525 horse power. It will be capable of handling a load of 400 horse power, with a reserve unit for operation in case of accident. For instance, if the larger engine should get out of order the smaller engine could be connected to both generators No. 1 and No. 2. The provision for admitting high-pressure steam into the low-pressure cylinder and the capability of the engine for standing an overload have already been mentioned. By taking advantage of these arrangements the smaller Corliss engine can be made to double its rated horse power and carry the load of the larger engine. To secure the same reliability and wide range of economical operation with an ordinary direct-connected plant would require four separate engine units, which would not only be more expensive in first cost, but would require larger foundations, greater floor space and more piping, as well as demand a larger amount of attention in operation.

FIG 6. ELECTRICAL EQUIPMENT OF A MODEL PRINTING ESTABLISHMENT.—GENERAL VIEW OF BINDERY.

The engine and generator foundation consists of a solid monolith of concrete eight feet deep and of sufficient width to give ample footing for the machinery. Water-tight iron pipes run through this foundation and under the cement floor of the engine room to the back of the switchboard for the purpose of carrying the generator leads. These leads consist of stranded rubber-covered and braided lead-encased cables of 600,000 circular mils cross-section area.

The switchboard is of highly polished black enameled slate, 1½ inches in thickness, with the usual indicating and regulating instruments. Separate omnibus bars are provided for the power circuits and the lighting circuits. Each generator is furnished with two main switches, by means of which it may be operated on either the light or the power circuits, or upon both at the same time.

Each feeder leaving the board passes through a fuse, the fuses being fastened in a row upon a special fuse block at the top and back of the board. From this block the feeders pass directly through the wall of the engine room into the factory. The power and lighting distributing systems throughout the plant are independent of one another. In the factory two main distributing centers are located in a central position, one on the north wall of the bindery and the other on the north wall of the press room. These centers consist of small switchboards fastened to the side of the wall and surrounded with a hardwood asbestos-lined cabinet. Their main bus-bars are connected back to the switchboard by means of large fender cables. At each center a separate cabinet is provided for the lights and power, the various circuits leading to the different parts of the building leaving the distributing board through suitable switches and fuses. The main feeders are carried along the wall of the electrotype foundry to the press room. From here they are carried on the under side of the iron roof truss by being supported on porcelain insulators fastened to iron beams, which are firmly bolted up against the angle iron of the roof. The distributing circuits are carried upon porcelain insulators attached directly to the under side of the wooden roof beams and above the iron trusses. All the feeders and mains are thus installed in the "open work" style of construction. A workmanlike job has been done, however, and the wiring presents a very neat appearance.

The leads to the various motors and the wires to the arc lamps and switches are carried in iron-armored insulated conduit. In the case of a press motor, for instance, a porcelain cutout in a suitable box is placed at the top of an iron column 12 feet from the floor. From the bottom of this cut-out box a single run of conduit is led down the side of the column, and thence along a groove in the floor to the motor. All the wiring about the presses, between the main switch, the controller and the motor is carried in iron conduit in such a way as to be thoroughly protected from mechanical injury.

The lighting of the plant is accomplished by means of constant-potential enclosed arc lamps. Experience has shown that a very satisfactory illumination can be obtained by hanging a lamp in the middle of each bay and from every other roof truss. This makes each lamp supply light to a floor space 29 by 32 feet. Where better illumination is required for any special work, incandescent drop lights are placed, and sometimes, as upon the presses, portable incandescent lamps with an allowance of cord are provided for work requiring occasionally a temporary light.

The arc lamps are controlled by double-pole, 220-volt snap switches carried on slate bases, securely attached to the side of the iron columns. The wiring to and from the switches and to the arc lamps is run in iron-armored conduit fastened to the columns and to the under side of the roof trusses. At every lamp opening the conduit contains a tee looking down, and to this tee is screwed a short nipple carrying a hook upon which the lamp is hung. By this method of installation the wires are entirely concealed. Each set of four lamps is protected by a cut-out placed in a manner similar to the ones protecting the motor leads.

There are installed in the plant at the present time a total of 95 motors, distributed as follows:

	H. P.
Electrotype Foundry.	
17 Individual motors, belted or geared to dovetailing machine, trimmers, planers, roughers, saws, routers, black leaders, molding machines, beveling machines, blowers and jig saws	21
1 Direct-connected to electroplating dynamo	10
Bindery.	
15 Belted to shafting driving folders, book-covering machines, trimmers, sewers, wire-stitchers, sewing machines, case makers, embossers, rounding and backing machines	52
2 Direct-connected to shafting driving cutters and smashers	10
8 Individual motors belted to knife-grinders, tying machines and gluing machines	18.5
Stock Room.	
2 Belted to shafting driving cutting machines, rotary board cutters, grinding machines, sizing machines and bevelers	6
Heating Apparatus.	
1 Belted to blower fan to heat office	12
Machine Shop	
1 Belted to line-shaft driving machine tools	10
Composing Room.	
1 Belted to shaft driving type-setting and distributing machines	3
Press Room.	
6 Belted to job presses, ink grinders and bronzing machines	5.5
41 Directly attached to presses	173
Total horse power of motors installed	321

The motors throughout are of the Lundell type. This motor is made with one field coil, which is entirely protected by the form of the field casting. The armature is of the ironclad type with removable form-wound coils. The motors have a steady neutral point of commutation and do not spark under sudden changes of load.

The motors directly attached to the presses and shafting are multipolar, narrow in width, with a relatively large circumference of field frames. The commutator, like the armature, is narrow and of large diameter, with a large number of bars.

There are various considerations which usually

determine in each case whether a motor should be belted, geared or directly attached to a machine, or perhaps indicate that the machine should be grouped with others of its class and driven from a common shaft. For instance, there are certain classes of machinery, such as folders, stitchers, type-setting and type-distributing machines, etc., which take but a very small amount of power, which are each in operation almost continuously and which can be arranged in rows convenient to a line-shaft. There are few, if any, advantages to be gained by driving such machines with individual motors, and especially is this the case when the driving shaft can be placed below the floor, as is done in the plant under consideration. Fig. 7 shows a number of groups of this class of machinery. The machine belts pass directly down through the floor to pulleys carried upon a shaft supported by floor stands bolted to planks in the bottom of the shaft pit. This pit is built with a concrete bottom and brick side walls, and is covered with the floor built in sections, so that it can be removed for purposes of inspection and oiling. The shaft is driven by a belted motor set upon a stand at the wall end. This motor rack is made of three-by-three-inch timbers, securely bolted together, and fastened to the floor. Underneath the motor and between the legs of the rack is placed the starting box. This box is mounted on a slate base, which also contains the main-line switch and the fuses for the protection of the motor. Each box is also provided with an overload attachment which will break the circuit in case of an excessive current. As a rule the motors belted to a line-shaft in this way are shunt wound and run at a speed of 1,000 revolutions per minute.

It may seem strange, in view of the admitted losses in line shafting, that any shafting whatever was allowed in the plant, but when the inefficiency of very small motors and their comparatively large cost of installation are considered, reasons will not be found lacking for putting a limit on the tendency toward individual machine driving. In some cases, such as paper cutters, smashers or embossing machines, which depend largely upon the inertia of their moving parts to furnish the power for their operation, a great advantage is gained by having a number belted to a line-shaft, and thus operated by a common source of power, for, under such conditions, each machine gets the benefit of the stored momentum of the flywheels of the entire line. A case in point is shown in Fig. 7, which illustrates a row of cutters. Here are six cutters and a book-binding machine operated by one five horse power motor. Individual driving would have required at least seven one-horse-power motors, and the result would have been far from satisfactory or economical. On the other hand, there are machines which may take a small amount of power, but which are in operation only intermittently, or perhaps cannot be conveniently located in positions to be belted to a line-shaft. Such instances are found in the electrotype foundry, Fig. 8, where there are numerous small machines, each with its individual motor either belted or attached by gearing.

The method of driving the large presses, however, presents the most problems. Here the conditions of operation leave but little doubt that individual motors should be provided. But whether to belt, gear or direct-connect the motor to the press is the problem. The belted equipment is the cheapest, the easiest to buy and install, and the more convenient to repair, as an injured motor can be quickly replaced. The higher speed at which they run furnishes a certain amount of inertia to carry the press over the "centers" of each impression. The belted motor takes up valuable room, however, and as it must be protected it usually presents an unsightly appearance. The geared motor can be installed in most cases and is an improvement over the belted type, though the increased cost of its installation makes its advantage a doubtful one. The directly connected motor takes the place occupied by the driving pulleys of a belt-driven press, and thus has the advantages of neatness and compactness. As presses are usually built, the main driving shaft makes five revolutions to every impression, so that a press operating at 1,440 impressions per hour requires a direct-connected motor running at 120 turns per minute. This slow speed means a large and comparatively expensive motor. Its armature must be keyed directly to the press shaft, and this often means that the shaft of the old press must be taken out to have an extension welded upon it. The slow speed of the armature prevents the accumulation of energy to help the press over the centers. In spite of these disadvantages, however, the improvement in the mechanical design of the equipment with direct-connected motors over the belted or geared arrangements, and the longer life of the slower-running motors were thought to be sufficient to justify the extra investment, and, therefore, motors directly connected to the 41 presses were installed.

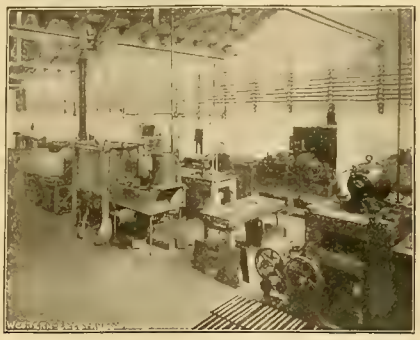


FIG. 8. ELECTRICAL EQUIPMENT OF A MODEL PRINTING ESTABLISHMENT.—ELECTROPLATING

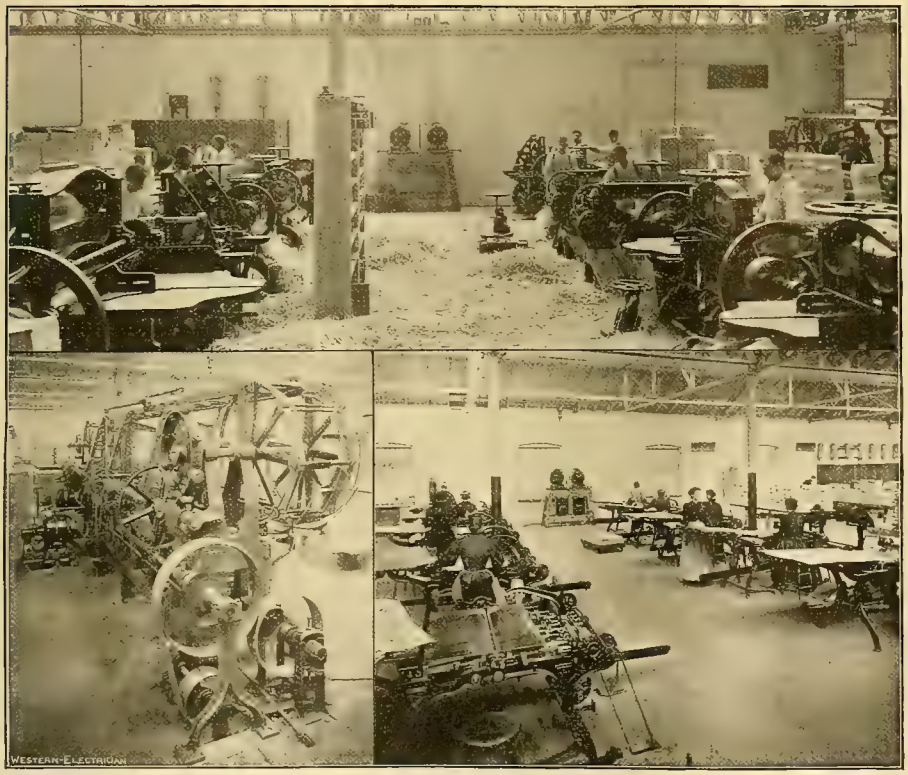


FIG. 7. ELECTRICAL EQUIPMENT OF A MODERN PRINTING ESTABLISHMENT —MOTORS DRIVING MACHINERY IN BINDERY.

The control of the press motors presents a number of difficulties, and the solution which has been worked out in this case may prove of interest. A printing-press controller should have a handle placed within easy reach of the feeder, by means of which the press can be conveniently started and stopped. In case of a failure of the current from any cause, the controller should be automatically released so as to return to the "off" position. It should have a locking attachment so that the press-room foreman can adjust the press for a certain number of impressions per hour, and then leave its operation to the feeder. This locking device should not interfere with the stopping or starting of the press, but should insure that while the press is in operation it will be running at the predetermined speed. With ordinary electric press controllers the convenience with which the feeder can change the speed of his motor is a temptation to "soldier" when not working directly under the eye of the foreman. The controller should provide for at least two back-up speeds and should have a handle on the side of the press opposite the feeder, by means of which the press can be run slowly in either direction in "making-ready" operations.

The most important requirement, however, is to secure a wide range of speeds for the press. For instance, it is sometimes desirable to be able to operate a press at a number of speeds ranging between 1,000 and 2,000 impressions per hour. This means that the motor should be controlled between 84 revolutions per minute and 168 revolutions per minute, or that its lowest speed should be 50 per cent. of its highest speed. Now, the speed of an electric motor may be varied in three different ways: (1) resistance may be inserted in series with the armature, (2) the intensity of the field magnetism may be changed, or (3) the external potential applied to the motor may be altered. The first method is uneconomical and unsatisfactory in operation, as it results in an unsteady speed under such a variable load as is given by a printing press. The second method, while more economical than the first, is limited in its application, for the speed of a motor cannot be satisfactorily controlled in this manner beyond the limits of about three-quarters of its full speed. To extend this range of speed and insure sparkless operation at the higher limits when the field is weakened, a large and expensive motor will be required. The third method requires complicated generating machinery and distributing circuits, and if but two voltages are used (one double the other) the system will not secure the range of speed desired.

The system of control adopted for this plant combines the first two methods. Between full speed and 75 per cent. of full speed the speed variations are secured by changing the field magnetism. This is accomplished by cutting in or out sections of the series field winding. Between three-quarters speed and one-half speed the various steps are secured by inserting resistance in the armature circuit. Three-quarters speed is taken as the average or normal speed of the press, and at this point all series field coils are cut out, and the motor is operated as a straight shunt machine with no resistance in series with its armature. In this way the main controller provides for 10 variations in speed, five of which are secured by armature resistance and five by field commutation. An auxiliary resistance box is placed on the motor or adjusting side of the press, by means of which 10 additional speeds can be obtained between any two of the main controller speeds, so that this method of control secures many different speeds, and it is, therefore, possible to operate the press with a fine adjustment and always at the highest rate which the character of the work will permit.

The diagram of the controller connections is shown in Fig. 5 and the construction of main controller in Fig. 4. The steel rod passing down from the handle at the left of the press feeder, Fig. 3, operates the contact arms by means of a bevel gear. These arms carry carbon brushes, and, passing over the segments, cut in or out armature resistance and series field windings. The contact arms are held in a semi-circular cast-iron connection which contains a series of small holes corresponding to the number of speeds secured by the controller. Pivoted at the center is a movable arm fitted with a handle and pin which can be made to enter any one of the 10 holes. When the current is turned on and the controller revolved, this arm moves around until it engages a pawl operated by an electromagnet. As long as the current is passing through the motor this magnet holds the controller in position, but it will release the arm as soon as the current is interrupted, and a strong spiral spring on the controller rod immediately brings the arm back to the "off" point. The "automatic" device is thus secured, while the locking feature is obtained by means of the movable arm, which can be set at any hole corresponding to any desired speed. The hole corresponding to the normal speed is marked and the press is usually operated on this point.

On the right of the feeder is placed a small panel board containing the main-line switch, a circuit breaker and fuses for protecting the motor. The switch is of the "tumbler" type and is connected so that when thrown up it connects the motor ready for operation. When this switch is opened an extension of each blade makes a contact with the lower clips so as to short-circuit the shunt fields of the motor through a non-inductive resistance, providing a path for the field discharge and thus avoiding the danger of a puncture. The circuit breaker is adjustable through a wide range, and is of the "time limit" type. In this type the acting magnet is shunted by an exposed coil of high-re-

[*Continued on page 276.*]

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Corruption seems to run rampant in some European capitals in spite of the efforts of certain well-meaning reformers to make the Americans believe that this is the only country where such practices are tolerated. Just now Vienna is said to be in an uproar because the municipal contract for street illumination seems to be controlled through corrupt influences. The members of the opposition to the administration are bent on ousting Dr. Lueger, who, in addition to being burgomaster, is leader of the anti-Semitic party in the provincial diet and likewise in the imperial parliament. Lueger has reopened negotiations with the Imperial Continental Gas company for the lighting of the city, after pledging his word not to renew the contract which terminates this month. It is claimed that Vienna is the worst lighted of European capitals, and that the man who is willing once more to hand over his fellow-townsmen to the corporation that is responsible for such a state of affairs not only has forfeited public confidence, but on the face of it is guilty of administrative corruption of the worst sort. Nor do the charges of corruption which lie against Lueger stop with those in connection with the lighting contract. The reports of the turbulent scenes in the meetings of the municipal officers remind American readers of frontier gatherings. In spite of the charges that have been uttered against the members of the government, it is believed that they will be permitted to remain in office.

The local electrical workers' organizations in Detroit has been urging the passage of an ordinance by the Common Council of that city providing for issuing licenses upon examination by the city electrical commission. This action was opposed by the commission, which declared, in a comunication to the council that the proposed ordinance was unnecessary, as the commission already had regulations covering the points raised in the ordinance of the electrical workers. It was also stated that the corporation counsel had expressed the opinion that in order to render effectual a provision in the proposed ordinance requiring the commission to issue permits and badges to inside electrical wire workers, an act of Legislature authorizing such proceedings would have to be secured. The council, however, adopted the measure.

Similar action has been urged in Hartford, where the Electrical Workers' union is endeavoring to secure the enactment of a law requiring all men employed in electrical construction, whether in buildings or in the streets of the city, to be licensed. The proposition is opposed by the local insurance interests and the electric-lighting companies. Representatives of these interests declare that ample protection is now afforded by the system of indoor inspection of electrical work conducted by the underwriters' electrician, while the city's electrical inspector of outdoor work and the inspectors of the electric companies look after all wires in the open. It was insisted that examinations for licenses should be conducted, not by members of the union, but by experts not connected with them or with any of the corporations.

As a general proposition it may be said that too many safeguards cannot be provided to insure good construction, but it is questionable if examinations conducted by a commission controlled through political influence can serve any good purpose. There has been altogether too much politics in electrical affairs already.

The question of municipal ownership of telephone exchanges is not confined to Great Britain, although there is much more discussion of the subject in Manchester, Glasgow and London than elsewhere. The city of Columbus is looking for distinction in this direction, or rather some of its councilmen are advocating an experiment of this kind. One of the leaders of this movement has propounded a few wise observations on the subject. They are not entirely consistent, it is true, but they are delivered with an air of wisdom that is really imposing. Councilman Marshall, for such is the leader's name, says:

Investigation shows that the charges of the Bell Telephone company, where competitive companies have established plants, have been reduced from one-third to one-half. Its profits are enormous.

The truth of this assertion cannot be questioned. Not so, however, the following:

The cost of telephone service is not lowered by competition, although the number of subscribers is usually increased.

Mr. Marshall goes on to say that "in many foreign countries private ownership of telephone systems is a thing of the past; in places where it has not been abolished, far higher prices prevail." This is misleading, at least. The same criticism applies to the following statement:

There can be no doubt that under public ownership the charges for telephone service can be made cheaper than under private ownership, in any country.

Mr. Marshall should be encouraged in his efforts to procure an efficient and inexpensive telephone system for his constituents, but he should study the question carefully and make a more thorough investigation of the subject before advocating such a radical change as that which he contemplates. There are many difficulties involved and many problems to be solved in the establishment of local independent exchanges without needlessly encumbering them with such complications as municipal ownership.

It is generally believed that residents of crowded city districts are the principal, if, indeed, not the only beneficiaries of the development of the electric railway, but now it is contended by well-informed residents of farming communities that the people of the rural districts are equally benefited. For instance, the American Agriculturist attributes the quietly growing but highly important changes in agricultural communities near cities to the trolley, and the same authority points out that farming lands thus favored have advanced from five to 25 per cent. in value. It is explained that thus far this is due not so much to the relative nearness of a market as to the increased demand from city residents who wish to enjoy country life. This is expected to mean much ultimately to agriculture. The city people gradually stay longer at their summer homes, and when there are good schools in the vicinity the summer sojourners often become permanent residents. All this enables the country town to afford the betterments which make life worth the living, and this improvement, socially and financially, may in certain restricted regions restore to farming some of its lost favor. In spite of all that has been said against it the overhead trolley has greatly improved the condition of the people in large cities and in suburban towns, and now it seems destined to effect an even greater improvement in the agricultural communities.

The Allen law was the principal issue in the political campaign just closed in Illinois. Members of the last state Legislature were measured by their attitude toward that bill, and no matter how good their record might otherwise be considered, their fitness for re-election was determined solely by their position with reference to street-railway franchises. Many of those who had voted for the Allen law sought re-election and pledged themselves to support a bill to revoke the Allen law at the next session of the Legislature. It is now generally agreed that aside from the merits or the faults of the Allen law it was a mistake to force such a measure through a Legislature, however friendly toward the street-railway interests. It had the effect of causing the opponents of such legislation to combine and throw the weight of their influence in favor of the election of men avowedly hostile to the street railways and other corporations operating under public franchises.

Under the terms of the Allen law the City Council of Chicago is empowered to grant franchises for 50-year periods, where previously 20 years had been the limit. It stipulates that in extension ordinances the fare must be five cents for the first 20 years. The greatest objection is that it alters the relations between the city and the existing street-railway companies and provides a method of dealing with existing companies different in important respects from the method provided for dealing with new companies. Restrictions thrown about the granting of new franchises are not made applicable to the extension of existing franchises. Before the Allen law was enacted the companies had no right to go to the council for extensions until their old franchises expired, but now they may go any time and ask for 50-year extensions, no matter when they may expire, and it is to be expected that the companies will select a time when the council is especially favorable to them.

Another consideration involved in the controversy over the Allen law, which was brought out conspicuously during the campaign, was the opposition that must be engendered by such methods as those employed in securing the enactment of the objectionable measure. Corporations cannot openly disregard public sentiment without awakening active hostility in the community, and the prominence given this issue during the campaign just closed may be said to have been due as much to the methods employed in securing the adoption of the Allen law as to the obnoxious features of that bill itself.

A Scotch View of American Patents.

The American patent system is, all things considered, probably the best in the world. Still it is interesting to note how much more benencent it appears to foreigners than to American inventors of actual experience. An example of this enchantment lent by distance is given below. The idea that an American patent is "absolutely secure" is especially noteworthy.

A correspondent writes to the Glasgow Herald as follows: "In opening new granite-crushing machinery at Dalbeattie last Saturday, Mr. Maxwell, in view of the fact that the machinery had come from America, said it was a disgrace to this country that all the skill and material had to be got from America, and asked whether there were not enough of mechanical skill in Britain. In my opinion the explanation of this disgraceful fact is not far to seek. It is found in the vast difference there is between the patent laws of Britain and those of the United States.

"On this side of the water every obstacle is thrown in the way of the inventor; on the other side he has every facility and asistance afforded him. In this country, after the inventor may have spent a large sum in experiments and models, he has to employ an agent to make a thorough search through all previous patents in order to make sure that his invention has not been anticipated or will not be an infringement of some existing patent. If he takes out a patent it will cost him about £100 in Patent Office fees and taxes during its currency of 14 years. For this money what does he receive? Nothing more than merely the registration of his patent. The Patent Office gives him no help and no directions except a copy of its rules. It does nothing to defend him against pirates, and if the patent be infringed, or the invention stolen, the patentee must secure his own rights by a costly lawsuit.

"That there should be some charge for the registration of an invention is reasonable, but the taxes levied go far beyond the cost of Patent Office management, costly as that red-tape institution is. The government derives from these taxes an income of £80,000 a year, while, on the other hand, not one inventor in 10 makes a penny of profit by his invention. Why should it be that an author has a free copyright in his own book while an inventor is fined?

"When we turn to the United States a very different state of matters is found. The Patent Office makes an exhaustive search through all the patent records of the world. If the invention is found to be a novelty a patent is issued whose validity cannot be questioned except on the ground of fraud. For all this the patentee pays no more than a tenth of what is paid to our office for mere registration, and his patent, which is absolutely secure, lasts for three years longer than a British patent. The procedure of the German Patent Office is akin to that of the United States. It will be seen, therefore, that while in our case patents are rendered as insecure and expensive as possible, our great rivals in business have every facility and security given them, and at only a tithe of what is paid by us. I am amazed that such a state of things is permitted to exist in our country. If any M. P. will bring up the matter in Parliament, and succeed in getting our patent laws assimilated to those of our successful rivals, he will do more for the promotion of British industry than any legislation that has been passed during the last quarter of a century."

Chinese Telegraphy.

In an article in the current number of the Engineering Magazine on "Industrial Progress in China," by J. S. Fearon and E. P. Allen, these interesting statements are made: "The telegraph is the only institution of modern science which has obtained any considerable foothold in China. Peking is connected by wire with Tientsin and with Manchurian points up to the Russian frontier, whence connection is continued by Russian Siberian lines to Europe. The capital is also connected with all the treaty ports and principal cities in China proper, and these again with each other. Canton has connection also through Yünnan with Burma. China learned the value of the telegraph in the war with France, and it has long since been admitted to have 'become indispensable.' The telegraph, however, is under imperial control, and there is probably little opportunity for its extension as a private enterprise. Chinese writing being not alphabetic, but syllabic, and there being as many characters as there are words in use, the telegraphic messages are sent in a number cipher. For transcribing messages received a double-ended type is used; on one end is the character, and on the other the corresponding number. When a message is received, it is set up by the numbers, and then printed from the reverse, or character, end."

Opening for Electrical Blacksmiths.

[Advertisement in London Daily Chronicle.]

ELECTRICIAN and engineer required by Mr. Jeremiah Colman, at Gatton Park; competent to take charge of electric lighting and plant, and a 20 horse power gas engine; able to use anvil and execute repairs to ironwork; preference given to a man who can shoe horses; unexceptional references for respectability and competency. Apply, letter only, C. Trevor Wheeler, Esq., agent Gatton Park, Surrey.

Street Railways for Japan.

An American syndicate, directed by Chicago, Philadelphia and New York capitalists, is considering the advisability of establishing a street-railway system in Japan under an exclusive franchise from the government. The Japanese consul in Chicago is reported to have given the following explanation of the conditions that prevail in his country:

"At present there is the horse-car line established in Tokio in 1882 and the trolley lines of Kioto. There is a committee on railways consisting of about 50 members, and one of their number has recently visited the United States, England and Germany. As many as 12 applications from Japanese companies have been before the committee at once, but now these are all consolidated into two companies, and they are still asking for charters. These have neither been granted nor refused.

"Foreigners are unable to understand why the Japanese go without street railways. We have been so long without them that we intend now to wait until something that seems to be permanent and practical is brought out, and, of course, we rather expect that when it does come it will be from the United States. Only a week ago I had a letter from Tokio asking about a pneumatic railway they had heard of and whether any such line was yet completed here. They are studying both the overhead trolley system and the underground. Neither of these seems to be practical for Japan. The hurricanes have made trolley lines dangerous, tearing down the wires and tangling them up with others. An earthquake shakes Japan once in every two or three years, and that would endanger any expensive underground system. None of the streets of Tokio is more than 90 feet wide, and this has also to be considered in plans for street railways.

"When a system is found that seems desirable the Japanese government would doubtless be willing to grant franchises. It is America that is perfecting this system, whatever it shall be, and capitalists, if they are planning for investments, are anticipating the time when the government shall grant franchises."

Telegraphic Difficulties in Cuba and Porto Rico.

It is stated that the signal-service telegraph operators of the United States army in Cuba and Porto Rico will not handle commercial business unless especially directed to do so. The question of telegraph lines in the islands is one which promises to be a source of trouble. In both islands the telegraph lines were the property of the Spanish government and were operated by that government while in possession. The United States will take charge of these lines, along with other government property, when the Spaniards evacuate, but the disposal of them is a question of considerable importance. They are in a very bad state of repair and have in many cases been destroyed, so that it will take a great deal of work and money to place them in good condition. General Greely, the chief signal officer of the army, does not feel that he has the money to spare or the authority to spend it for placing these lines in repair for commercial purposes unless directed to do so by the commanding generals. Of course, if the government were to retain possession of the lines it would lose nothing by putting them in proper shape, but as those in Cuba will probably be turned over to the Cuban government, any money which might be expended on them might be lost. In Porto Rico, which is now a part of the United States, the conditions are somewhat different, but there the principle of government ownership is involved. It is possible that the government may decide to sell the lines to a private corporation, but this will be a matter for Congress to determine.

Electrical Operation of Warship Turrets.

In describing the United States battleships Kearsarge and Kentucky, now building, the Engineers' Magazine discusses briefly the project of using electrical power for the operation of the gun turrets. As naval engineers know, the question of turret-turning gear presents a problem with which all nations, the United States included, have been grappling for years. The whole matter has not as yet passed the experimental stage. Steam, hydraulic, pneumatic and electrical power have all been utilized for the work, and the advocates of the last named have lately been particularly active in the presentation of the claims of their favorite method.

The electrical gear has been utilized in the English, French, Russian and German navies for the turning of small turrets, and in some of the more recently constructed vessels of the Russian and French navies for larger turrets as well, and so, except in the matter of a direct comparison, there was nothing original in the installation by the United States of electrical turning gear for two of the eight-inch turrets on the armored cruiser Brooklyn, while steam was retained as the propelling power of the other two turrets.

The results seemed to rather favor the electrical installation, but they were to such a degree superficial that the officials determined to make a thorough test. The battleships Kearsarge and Kentucky were selected for this work, and these vessels have been equipped with electrical motors throughout the turrets for the control of all operations. As this means the operation of the heavy mechanism of the 13-inch turrets, superimposed with eight-inch turrets, the test is the most severe that has been made by any government at any time, and will be watched with interest everywhere, for the reason that it will, if successful, establish conclusively the superiority of the electrical mechanism.

There is no denying, however, that this feature is considered an experiment, and while the department has confidence that the electrical system is capable of greater progress and improvement than any other now in use, the utilization of electricity for turning gear will be confined to these two vessels until they shall have been in commission long enough to permit of the compilation of some definite data.

Electrolysis at Dayton, O.

From Harold P. Brown's report of the damage done to water mains in Dayton, O., by electrolysis the following summary is made:

"(1) The area in which the pipes are positive to the rail, and therefore suffering injury, runs fully half a mile to the west of the power houses, on the left side of the Great Miami River, and for a mile to the east. This area is ordinarily confined to a radius of a quarter of a mile from each power house.

"(2) The cast-iron pipes in the district just mentioned seem upon examination to be in excellent condition, since the coating when first exposed is black and even, and could easily be mistaken for the black paint ordinarily applied to the pipes. But on close examination it is found that the paint has entirely disappeared and the soft, black coating is a part of the pipe itself, but can easily be scraped off with a knife. On exposure to the air this black coating gradually turns to the ordinary color of iron rust, but retains its light and spongy character.

"(3) The salts and alkalies of the soil seem to form a solvent for both iron and lead in presence of the electrical current, since the stones surrounding the pipes in the district above mentioned are actually electroplated with the metal from the pipes. This condition has never been reported elsewhere to my knowledge.

"(4) In the attempt to check electrolysis the roads have put in a great number of Falk cast-welded joints, replacing ordinary joints, which were previously bonded with No. 00 wire. Measurements were taken in February last along Third street, from the bridge to St. Clair street, before the cast-weld was applied. After the rails on this same street were cast-welded my examinations were made, and my readings were practically the same as those made in February, the only variation being that due to the increased summer traffic. The rail ends had been cleaned with a sand blast before the cast-welding was applied, and I am informed that the work was done by one of the experts of the company. Mechanically considered, the joints are magnificent, but their electrical conductivity is very low.

"(5) The unusual conductivity of the soil, which shows indications of the current for 15 to 20 feet from the rails and pipes, may be either alkaline matter contained in the soil itself or derived from leaks in the natural-gas or artificial-gas pipes. If the latter is determined by chemical analysis to be due to gas leakage, a very interesting legal question will be raised concerning the responsibility for the damage.

"Since a casual inspection of the cast-iron pipes would have led to report that they were in good condition, the same state of affairs might exist in other cities.

"The Dayton conditions are so unusual that no method of electrolysis prevention heretofore suggested would be efficient."

It is pointed out by the Railroad Gazette, from which the quoted paragraphs are taken, that tests of cast-welded rail joints in Chicago have shown a different result—a very slight drop in the current at the joints of this character.

Cable-car Parties.

[From the Chicago Record.]

The man who invented trolley parties gave the world a new means of relieving the tedium of daily life, and society is his debtor. But that he did not exhaust the possibilities of the street-railway line as a means of distraction was shown Thursday night, when the North Side cable system abruptly suspended operations.

Hundreds of homeward-bound theater-goers took seats in the cars wholly unaware of the treat in store for them. They expected nothing more than a commonplace trip home. Instead they were allowed for hours to sit on the luxurious seats, to hang to the handsome leather straps or to loll gracefully upon the platform railing. Those inside were at liberty to breathe unreproved the crisp night air, and even to sleep in the seats, while the night life of a great city rolled around them as in a panorama. And the charge was five cents!

Without wishing to cast discredit upon the invention of the trolley party, it may be said that both in the variety of the entertainment offered and in the length of time which it occupies the new amusement is superior. Chicago will wait with eager interest to see what further entertainments the versatile North Side cable has in store.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The long-distance telephone company in Martin County, Minn., has had considerable trouble over its right-of-way, and the end is not yet. Last spring a commission was appointed to appraise damages for a right-of-way adjoining the Chicago, Milwaukee and St. Paul railway right-of-way. A six-foot strip was sold to the telephone company. Now the railroad company asks damages, for the reason that the poles, set in the center of the six-foot strip, interfere with the setting of its snow fences. The railroad company wants the telephone company to place its poles on the line dividing the telephone company's and the farmers' lands.

A meeting of all the independent telephone companies of Western Wisconsin and Southern Minnesota was held in Winona, Minn., recently, and a pooling arrangement was effected to make a strong alliance against the Bell interests.

By the purchase of the telephone system of the Western Electric Telephone company, the Northwestern Telephone Exchange company has come into possession of lines between Waseca and Mankato, Minn.; Janesville to Alma City, Alma City to Vivian, Alma City to Cream, Wis.; Cream to St. Clair, St. Clair to Eagle Lake, Eagle Lake to Madison Lake; also lines from Mankato and St. Peter and Sioux Falls, S. D., to Luverne, Minn., and stations at 21 towns and villages. The Northwestern Telephone Exchange company has made a traffic arrangement with the Fairmont Telephone company of Fairmont, Minn., and agrees not to parallel the latter's lines west of Fairmont. The same company has completed its toll line between Brainerd, Minn., and Little Falls.

The poolrooms of Anaconda, Mont., and Butte have been closed because the Western Union objected to the news being telephoned from Butte to Anaconda. Notice was served on the managers of the Butte poolrooms to stop sending the service over the telephone, and when no attention was paid to it, the telegraphic service was shut off. Anaconda has complained of its telegraphic service.

The Northeastern Telephone company of Rush City, Minn., is arranging for toll-line connection with the Twin Cities. Lines are being built through Lindstrom to Taylors Falls, and also to Hinckley.

The Midland Telephone company has completed a line between Adrian and St. Kilian, Minn.

It is reported that J. C. Hubinger of Keokuk, Ia., has made application for a loan of $500,000. He is said to have given as assets real estate worth $250,000 and franchises at Minneapolis and St. Paul and elsewhere at $1,000,000.

The Minnesota Central Telephone company is about completing a toll line between Elbow Lake and Barrett, Minn.

The Northern Minnesota Telephone company's toll line is now completed from Hubbard, Latona and Menahga to Park Rapids, Minn. The company will build to Badoura and Pine Point as soon as conditions warrant. A line will be extended south to Wadena at once.

The Iowa Telephone association, composed of the independent telephone companies in Iowa, held a recent meeting in Des Moines to agree on tolls and the division thereof. The companies represented have connection with 184 towns in the state. New lines are being constructed which will increase the number considerably. The Central Telephone company is building to Oskaloosa and Ottumwa and expects to have the new line completed by December 1st. A metallic-circuit line will be built from Fort Dodge to Sioux City by independent companies. The Southwestern Telephone company will soon have completed a line to St. Joseph, Mo., and it is preparing to connect with Council Bluffs and Omaha.

The franchise of the telephone company at Creston, Ia., is about to expire. The press urges that no new franchise be granted, but that the company be permitted to continue until such time as the city can put in an exchange.

The Northwestern Telephone Exchange company is building a toll line west from Valley City, N. D., to Jamestown.

The Rocky Mountain Bell Telephone company will soon have connection with Wallace, Idaho, and other Cœur d'Alene points.

The telephone exchange at Adel, Ia., is about completed. It is being put in by the Mutual Telephone company.

The Northwestern Telephone Exchange company announces that hereafter free telephones will be furnished the residences of those who have business service. The new Citizens' Telephone company will be in operation in Mankato by December 1st, and this is believed to be the first step in a telephone war.

The Rocky Mountain Bell Telephone company is rapidly closing up the break between Idaho Falls and Dillon, Mont., and will then have connection between Logan, Utah, and Dillon, a distance of 642 miles. The company has also connected with Idaho points at Huntington, and will soon be connected through Portland to the coast.

The Duluth (Minn.) Telephone company has been granted a franchise for a toll line from Duluth to Cloquet. The company has bought the line of John O'Brien to Carlton from Cloquet.

The Knoxville Electric company is building a telephone line from Bussey, Ia., to Swan, and west of there it will connect with the Indianola line, over which direct communication will be secured with Des Moines. At present a roundabout connection is made, but the service is not satisfactory.

The Spring Green and Wyoming Telephone company is a recent incorporation which will build a line between Spring Green and Wyoming, Wis. The line is completed and other connections will be made as rapidly as possible.

The new telephone company at Dodgeville, Wis., which has absorbed the Southwest Wisconsin company's system, is making a large number of improvements to the same.

New Virginia, Ia., now has telephonic connection with Medford and other points.

Surrender by Telephone.

[Richard Harding Davis, in Scribner's.]

The town (Ponce, Porto Rico) first surrendered to Ensign Curtin of the Wasp, then to three officers who strayed into it by mistake, then to Commander Davis and finally to General Miles.

Ensign Curtin landed with a letter for the military commander, which demanded the surrender of the port of the city. The captain of the port informed him that the military commander was at Ponce, but that he might be persuaded to surrender if the American naval officer would condescend to drive up to Ponce and make his demands in person. The American officer fairly shook and quivered with indignation. "Zounds" and "Gadzooks" and "Damme, sir," would have utterly failed to express his astonishment.

"How long will it take that military commander to get down here if he hurries?" demanded Ensign Curtin.

The trembling captain of the port, the terrified foreign consuls and the custom-house officials thought that a swift-moving cab might bring him to the port in a half hour.

"Have you a telephone about the place?" asked the Napoleonic Curtin.

They had.

"Then call him up and tell him that if he doesn't come down here in a hack in 30 minutes and surrender I shall bombard Ponce."

He turned his back on the terrified inhabitants and returned to his gig. Four hacks started on a mad race for Ponce and the central office of the telephone rang with hurry calls.

On his way to the ship Ensign Curtin met Commander Davis on his way to the shore. "I shall extend his time another half hour," said Commander Davis.

Ensign Curtin saluted sternly, making no criticism upon this weak generosity on the part of his superior officer, but he could afford to be magnanimous. He at least had upheld the honor of the navy, and he will go down in the history of the war as the middy who demanded and obtained a surrender by telephone.

Telephone Party in Kansas City.

On the night of November 15th the long-distance telephone from Kansas City to the large cities of the East will be formally opened. The telephone is actually in use at the present time, but the general public will have its first chance to converse with friends in the different cities and to listen to music played by a band in Milwaukee on the evening which has been set apart for that purpose. Manager Burt of the Missouri and Kansas Telephone company is arranging this treat for the members of the Kansas City Commercial Club, and in order that the occasion may be made more memorable, the members are to be invited to bring their wives and daughters.

The affair is to be called a "telephone party." In the large room of the club will be placed 50 transmitters. St. Louis, Chicago, Cincinnati, Philadelphia, Milwaukee, Boston and New York will be connected with Kansas City. It is proposed to have those who wish to converse with friends in those cities make the arrangements in advance. These friends will be near the telephones at which they are to be called up.

An interesting feature will be the enjoyment at Kansas City of music played by the Schlitz Palm Garden band in Milwaukee. Megaphones will be placed in the receivers and the music will be audible to all in the room.

Telephone Litigation in Washington.

The Telephone company and users of telephones in Washington, D. C., continue to be divided on the subject of rates for service. The Chesapeake and Potomac Telephone company has filed its answer to the proceedings for injunction instituted by A. Fred. Jorss, Charles A. Bryan and Eugene A. Bowers, to restrain it from removing its telephone instruments and appliances from their respective places of business. As in the answers to the other suits filed, the question of the constitutionality of the act of Congress of June 30, 1898, is raised.

Telephone Charges in New York.

[From the New York Commercial Advertiser.]

From letters received and information that has come unsought to the New York Commercial since the publication of the articles dealing with the exorbitant charges of the telephone monopoly of this city, it is plain that the topmost rung of the ladder of extortion has been reached, and the climbing-down process will soon begin, to the lasting relief of the oppressed business man of this city. Continual dropping will wear away a stone, and although the telephone monopoly has sought by every means during the many years that the fight has been kept up against their extortionate greed, to defeat the ends of those who fought for the people, the persistent determination to keep on pounding until a breach was made, has had its effect at last.

How the telephone monopolists have fattened at the expense of the business men of this city can be seen by the comparisons between the rates at which a reasonable profit is made in other cities, and the charges for the use of the telephone in New York. What does the New York business man think of the following figures showing the profits of the Metropolitan Telephone and Telegraph company, as taken from statements of that company, sworn to before the Ainsworth telephone committee:

Net profit in six years, 473.91 per cent. Net profit in 1885, over 116 per cent.; net profit in 1886, over 147 per cent.; net profit in 1887, over 145 per cent. This made it possible for the company to realize in six years, on an investment of $600,000, the enormous profits of $2,843,454.53.

No wonder that the telephone monopolists desired earnestly to be left alone after they had discovered such a philosopher's stone. The figures explain why they were willing to pay handsomely for the assistance of those who could quiet the disturbers, or at least drive them off.

It will be news to most New Yorkers who, as a distinguished Englishman remarked, are very prone to attend strictly to their business and allow to pass unnoticed evils that in England would arouse a storm of indignation, that there are about 2,000 rivals of the Bell Telephone company, so great has been the opposition to their system of extortion both in this and other cities. The reason that the existence of these rival companies has been unnoticed is that they have had their birth in the determination of opponents of extortion to establish local telephone services at a reasonable rate. They are scattered companies, lacking the alliance that gives a long-distance wire. Since the incorporation of the People's Telephone corporation there are indications that these scattered companies are to be consolidated, and if this result is brought about the elephant will find that he is no longer merely tormented by the attacks of a host of flies that a swish of the tail disperses, but by an enemy as big and powerful as himself. That the elephant is awakening to a knowledge of this danger the Commercial is in a position to know.

Looking back on the iniquitous reign of the telephone monopoly, the wonder is that the business men of New York have submitted so tamely to the raising of rates that, at the beginning, were none too low. Telephone charges were originally $60 per year. Then they were raised to $150 and $180 a year, and then, grasping ever and heedless of the fate that would inevitably be theirs when the worm turned, the telephone company jumped the rates 60 per cent., making them $240 a year.

It is time to call a halt. Relief is in sight now. The Legislature has failed to right the wrongs of those who have been forced unwillingly to swell the gains of the telephone monopoly. But the people are taking steps to end the extortion. The members of the Board of Trade and Transportation have added another to the many excellent things accomplished in the interests of the business community of New York.

Local News from Telephone Exchange.

The requirements of telephone subscribers are many and varied, and in some localities the demands that are made upon the exchange manager are very exacting as well as unique. Sometimes patrons become inconsiderate, as in the case of the Racine, Wis., exchange, and then the local manager finds it necessary to give vent to his feelings. Avoiding details, it may be explained that Manager Kernan of the Wisconsin Telephone company says that the people of Racine are rather countrified, and in support of this statement he alleges that every time a fire alarm is turned in they drop everything and run just as if they belonged to a volunteer company in a village. This does not worry him, however, but it seems that the few who don't run to the fire rush for the telephone, and in two minutes after the alarm is given, every telephone is calling "central" and asking, "Where is the fire?"

It is impossible, says Mr. Kernan, to speak to all the customers at once, and therefore the fire is often out before the indignant citizen gets a chance to satisfy his curiosity and impulse for information. Mr. Kernan expresses the hope that some of his patrons will learn to control their language when seeking information relating to "the fire."

Telephone Controversy in Windsor.

The Bell company and independent telephone interests in Canada are engaged in a lively controversy in Windsor, Ont.

"On two occasions the People's Telephone company offered to sell out to us," declared Chief Special Agent W. C. Scott of the Bell Telephone company, at a meeting of the Windsor Council. "But," he continued, "we absolutely refused to consider the offers."

E. O. Fleming of the People's company admitted in answer to a question by the mayor, that such an offer to sell had been made by Messrs. Larabee and Butterick. The mayor appointed a committee to investigate the deal between the companies. The council had earlier in the evening refused to grant a franchise to the Bell people.

The conditions in Windsor are similar to those in many American cities. For years the Bell company has done business under its Dominion charter, paying nothing for the privilege. In June, 1893, it was given an exclusive franchise for five years at an annual rental of $225, rates to subscribers being fixed at $25 and $30. This agreement expired last June. Early in May a Detroit man named Evans, in connection with Windsor merchants, secured a charter from the Ontario government and made application to the council for a franchise. Shortly afterward a third company, headed by Mr. Fleming, came into the field and also applied for a franchise. Both started canvassing for subscribers, and soon all was confusion. The council finally decided to ask for bids from the rival companies. Before these were received, the new concerns joined forces as the People's company, with Fleming as managing director, and submitted an offer of $500 a year, with subscribers' rates at $18 and $24. The Bell company did not tender. The special telephone committee recommended in favor of the People's company, when the Bell company secured a postponement. The Bell company offered the same annual fee as the others, but would not reduce its rates lower than $20 and $25. In the meantime the Bell company is offering its subscribers the benefit of reduced rates on a three-year contract.

Government Telephone Inquiry in England.

An indication of the interest manifested in the telephone situation in England is presented in the action of the government ordering the publication of a blue-book of 580 pages, containing the complete minutes of evidence taken before the select committee on telephones, together with the chairman's draft report and the final report. The London Electrician calls attention to one incident, which occurred during the discussion on the chairman's draft report, which it deems especially significant. It was proposed to recommend that local authorities should, on starting telephone exchanges, be given a guarantee that either the plant should be purchased at a fair valuation in 1911 or the licenses extended beyond that date; the draft report, and subsequently the final report, recommended that these licenses should expire in 1911, at the same time as the license of the National Telephone company. The committee was evenly divided on this point, and the amendment was defeated only by the casting vote of the chairman. This showed the disposition or predisposition of a large section of the committee to favor municipal telephony at any cost. The London Electrician also points out that "with the exception of two experts, whose position as independent consultants must naturally, if unconsciously, bias them toward independent telephony, none of the witnesses with practical experience in the establishment and management of telephone exchanges advocated the erection of municipal systems."

Alleged Bribe for Telephone Franchise.

There has been a good deal of excitement in Akron, Ohio, over the disclosures that have been made in connection with the application of the Central Union Telephone company for a franchise in that town. It is charged that Harvey C. Garber, acting for the company, offered a bribe of $300 to Daniel McGarry, a member of the Board of City Commissioners, to secure the passage of an ordinance enabling the company to establish its pole lines in certain streets and alleys of the city. The case was investigated and Garber was indicted for offering a bribe to a public official. There were four counts in the indictment. Subsequently Garber was released upon bail furnished by M. J. Carney, manager of the Central Union Telephone company, Charles Isbell and W. T. Tobin.

Internal Revenue Tax on Telephone Business.

The commissioner of internal revenue received a letter from the collector for the Thirteenth District, East St. Louis, Ill., in reference to returns to be made by telephone companies and life-insurance companies issuing policies on the industrial or weekly-payment plan. The collector's attention was called to a recent decision of the department, under which insurance companies receiving first weekly premiums in collection districts, through local agents, are permitted to include such premiums in the returns rendered in the district in which the company is located. The commissioner sees no objection to the adoption of the same plan in the case of telephone companies, where the conditions imposed are fully complied with.

Telephone Service on the Pacific Coast.

San Francisco and Seattle are now connected by telephone, the line between those points having been completed last month. This is a part of the plan of the Sunset Telephone and Telegraph company to build a line from San Diego, Cal., to Nelson, B. C. The right of way was secured along the country roads which parallel the railroads in California, Oregon and Washington, and the highways were used wherever practicable. From Seattle to San Francisco the lines run almost south in direction, and Portland and Tacoma can be connected. The Siskiyou mountain range is crossed in Oregon and California, and men will have to be stationed along the more exposed parts of the line at those points so that in time of storms communication will not be interfered with. The construction work throughout is said to be the best known in the art. A complete metallic circuit has been built and long-distance instruments of the latest type adopted. The cost of the equipment reached $250,000. John I. Sabin, president of the company at San Francisco, and F. C. Millard, superintendent at Seattle, opened the new line.

Telephonic communication between Portland, Ore., and San Francisco was inaugurated and perfected last month by the Pacific Telephone and Telegraph company of San Francisco. Mayor Phelan sent the first message over the line to Mayor W. S. Mason of Portland, and the latter made suitable reply. There was much interest manifested in the event by the business men of both cities.

New Non-infringing Automatic Shunt.

The accompanying illustration shows a new and unique way of automatically shunting the armature windings on exchange magneto-bells, in which G S represents the gear shaft which is shown in section at a point near the driving-dog D riveted and brazed onto the crank tube C T, which is also shown in section. P and P' are two pawls, which are mounted upon a brass cup-shaped disk C and are actuated outwardly by two flat steel springs S and S'. Either one or both of these pawls while in normal condition may press against a contact band A, which is mounted on the pole-pieces, so that its curvature is concentric with the gear shaft and insulated by means of hard-rubber blocks. The pawls are electrically connected with one end of the armature winding through the frame of the magneto-generator. To break the shunt or short-circuit, as in the operation of turning, the crank driving-dog D, which has two laterally extended ears, as shown by the shaded portion, engages two upwardly turned flanges of pawls P and P' and pulls them radially, thus breaking the contact between them and the insulated band A until they engage or lock on the gear shaft, when the further movement of the crank rotates the armature and generates current which delivered to the line wires.

The device is made by the Williams Electric company and used on its high-grade exchange magneto-bells.

Bell Company's Poles Chopped Down in Lansing, Mich.

For some time the Michigan Telephone company has been engaged in a controversy with the city of Lansing over the question of telephone poles. The city argued for a joint use of poles with the Lansing Telephone company, but the Bell company refused to acquiesce, and prepared for a settlement of the question in the courts.

On October 24th the City Council held an executive session and decided that the Bell company's poles must come down. The mayor acted at once, and when the citizens of North Lansing awoke from their slumbers in the morning, it was to find the streets strewn with the poles of the telephone company, the city's men having cut them down. As a consequence the telephone system in North Lansing was paralyzed for a time, but the Michigan Telephone company secured from Judge Person an order permitting it to replace the poles and wires and enjoined the city from further interference until further order of the court.

Not a Telephone War.

The following item, which is going the rounds of the daily papers, is evidently erroneous:

"The American Telephone and Telegraph company, incorporated under the laws of New York state, has complied with the Ohio laws relating to foreign corporations and filed papers with the secretary of state. This company was formed in New York to fight the Central Union Telephone and Telegraph company, and has a capital of $50,000,000. Only $50,000 is to be used for the present in Ohio, according to the papers filed. The principal office of the company in Ohio is to be in Cincinnati."

The American Telephone and Telegraph company of New York is evidently complying with the local requirements with a view of extending its long-distance service in Ohio.

Extensions and Improvements.

William Simpson, T. J. McCue, J. J. Grier, Elmer Ames and C. M. Sawyer of Norton, Kan., have completed arrangements for a telephone system in that town.

The Michigan Telephone company has notified the Detroit school board that it will have to pay half of the regular charges for the headquarters telephone service hitherto furnished gratis.

The City Council of Cleveland has authorized the Home Telephone company to transfer its franchise to the Cuyahoga Telegraph and Telephone company, the name of the reorganized corporation.

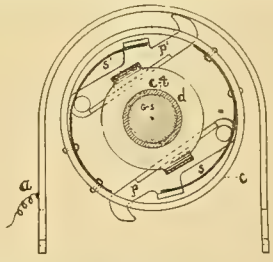
J. E. Tuttle, who operates a telephone line between Tillamook, Bay City, Hobsonville, Garibaldi and Nehalem announces that he will extend it to Seaside, a distance of 28 miles from Portland, Ore.

The City Council of Salt Lake City has refused to pass the ordinance introduced by the Rocky Mountain Bell Telephone company, and that corporation announces that it will not accept the ordinance which the council proposes to pass.

A franchise to build an independent telephone exchange in Lyons, N. Y., has been granted to S. E. and A. B. Bishop of Clyde. Trunk lines will be built connecting the exchange at Lyons with those at Newark and Clyde, which are already in successful operation.

The contract has been let to John Hiltz for the erection of a building for the Chesapeake and Potomac Telephone company at Baltimore. The structure is to be four stories high, 25 by 100 feet, brownstone front and modern in every respect. It will be devoted to the business of the company.

The Alaska Telegraph and Telephone company has secured a franchise from the Canadian government to operate telegraph and telephone lines in Canadian territory over the Chilkoot pass, beginning at Juneau and running along the lakes and down the Lewis and Yukon rivers to Dawson and Circle City. In return for the franchise the government is to have free use of the lines. The company was incorporated for $250,000. The officers are: President, Theodore Reichert, and secretary J. F. Fassett.



NEW NON-INFRINGING AUTOMATIC SHUNT.

The Central Union Telephone company has finished its work of construction of telephone lines in the neighborhood of Alton, Ill., and the exchanges at Brighton, Delhi and Jerseyville have been connected with the Alton exchange. "At Godfrey some trouble has been encountered in securing an agent for the telephone," says the Alton Telegraph. "No one has yet been found who is willing to have the station placed in his house, and until a suitable place can be secured the town will not have the use of the telephone line."

Chanute's telephone exchange has made a most remarkable growth. The exchange started one year ago the 1st of October with a list of about 40 subscribers. It now has 200, and the number is constantly increasing. In addition, Chanute is connected by long-distance lines with Humboldt, Paola, La Harpe, Moran, Bronson, Uniontown and Fort Scott. The Chanute Tribune ascribes the growth of this exchange to the excellence of the system itself and the readiness with which Kansas people adopt the conveniences of modern life.

The Lewiston (Me.) and Greene Telephone company has been organized for the purpose of operating telephone lines in Androscoggin, Oxford, Cumberland and Kennebec counties between the towns of Greene, Leeds, Poland, Lisbon, Durham, Lewiston, Auburn, Monmouth, Winthrop, Manchester, Hallowell, Gardner, Augusta, Vassalboro, Waterville, Oakland, Oxford, Norway, Paris, Woodstock, Bethel, Rumford, Brunswick, Freeport, Yarmouth, North Yarmouth, Falmouth, Deering, Westbrook and Portland. The officers are: President, William Williams of Monmouth; treasurer, Walter H. Brown of Lewiston.

The Cumberland Valley Telephone and Telegraph company has selected as directors Isaac Lesher, D. K. Appenzeller, E. M. Smith, W. L. Minick, Dr. J. O. Skinner, H. B. McNulty, C. C. Gelwicks, John A. Zullinger and D. L. Grove. The directors elected the following-named officers: President, D. K. Appenzeller; vice-president, Dr. J. O. Skinner; secretary, H. B. McNulty; treasurer, Dr. David Maclay. The ordinance, as passed by the Chambersburg City Council, was accepted. Work will be commenced at once, and all the wires in Chambersburg will be laid underground. The line will be extended to Fulton, Bedford, Huntington, Juniata, Perry, Dauphin, Cumberland and Adams counties, Pennsylvania, and Washington and Frederick counties, Maryland.

Fatalities Due to Electric Shock.

Earl R. Choat, an employe of the Cedar Rapids (Iowa) Electric Light and Power company, was killed by an electric shock recently while replacing a burned-out transformer with a new one in one of the company's circuits. He had been employed by the Cedar Rapids company only six weeks at the time of the accident, but he had represented himself to be an experienced lineman.

Fred N. Whetstone was killed while repairing a defective arc lamp in Beloit, Mich. The deceased had charge of the plant of the Beloit Electric Light and Power company. He had been working on the switchboard during the afternoon, and, it is thought, failed to connect up the circuits properly before turning on the current.

George Silkett and Sheridan K. Jones of Salt Lake City were victims of an unusual accident on October 27th, resulting in the death of the former and serious injury of the latter. The accidents were caused by a telegraph wire coming in contact with six big feed wires of the Union Light and Power company. The men with others were engaged in stringing wires on the new line being constructed by the Rio Grande Western and the Western Union, between Salt Lake and Park City. Silkett and Jones had charge of the big reel of wire, which was in the back end of a wagon, drawn by a single horse. Another man was up on the pole about three rods away, and had hold of a rope pulling the wire over the feed wires of the electric light company. He called to Silkett and Jones several times to get a board, as it would be safer for them in case of a contact in any way. This they did. The boards had just been placed on the ground and the men assumed their former positions, when, owing to the backing of the horse—a rather restless animal, it is said—the wire became slack, fell across the six electric feed wires, and carried the current to the men at the reel. Silkett was about 40 years of age, and located in Salt Lake about seven years ago. His parents live in Mills county, Iowa. Jones is a painter by trade. Neither of the men was a practical electrician, but both were supposed to have had enough experience in stringing wires to act as ground men. This is the second electrical fatality in Silkett's family. His brother-in-law, Edward Fritz, was killed in the Salt Lake and Ogden Electric Light Works a couple of years ago.

[From the New York Tribune.]

Baltimore, Md., October 20.—Two men were killed by live wires about one o'clock this morning in a heavy rainstorm. Abraham Stummer met instant death near his home, the deadly current being transmitted by his umbrella, the steel rod of which came in contact with an arc light that was hanging about six feet from the pavement. Harry Dunlap lost his life at Paca and Franklin streets, where he leaned against an awning pole, which had become charged with electricity by a fallen wire.

Mr. Stummer's right hand, in which he had held the umbrella, was terribly burned by the contact. The pavement and the soles of the man's shoes were wet. The man fell, and his umbrella came in contact with a colored man who was passing. The shock threw the latter to the ground, but he recovered sufficiently to walk to his home. Shortly before this a white woman who was passing had received a severe shock from the same light. Mr. Stummer fell on his knees, and died almost instantly.

Harry Dunlap was 20 years old. He was on his way home, accompanied by William C. Wollenberg. They stopped on the corner to say good-night, when Dunlap rested his hand against the awning pole and dropped dead. The current also severely shocked Wollenberg, who had hold of Dunlap's hand. He was thrown to the ground, but was not seriously injured.

A horse passing over a gutter plate at the corner was thrown, showing that the plates as well as the awning had become charged, the wet streets adding to the danger. The coroner is making an investigation of the matter. Accidents of this kind have been frequent in Baltimore, showing the necessity of stricter regulations in regard to electric-light wires.

Electricity in Medicine.

Dr. J. Brummel Jones of Kansas City read a paper on "Electricity: Its Uses and Abuses," before the Jackson County Medical society at its meeting in Kansas City, October 27th. The doctor told of numerous cases where he had used electricity to increase or to decrease the rate of heart beat; to correct irregularities in the heart's action; to reduce the pain of inflammation in the muscles and soothe irritations of the skin.

Duty on Incandescent Lamps.

[From the New York Commercial Advertiser of October 28th.]

The Board of Classification of the United States general appraisers to-day announced a decision regarding the tariff on incandescent electric lamps. The collector at this port assessed a duty of 60 per cent. ad valorem, under paragraph 100, act of 1897, which covers various articles of glass, or of which glass is the material of chief value, and blown glassware. A protest was filed by the importers, Knauth, Nachod & Kuhne.

The board holds that while glass is the component material of chief value, yet the other materials, carbon filament, porcelain, metal, and cement, are so essential to the character of the lamp that it ceases to be merely blown glassware. The board holds further that the goods are covered by paragraph 112, which includes manufactures of which glass is the component material of chief value, not specially provided for. The protest is sustained and the duty fixed at 45 per cent.

Electrical Equipment of a Model Printing Establishment.

[*Continued from page 271.*]

sistance wire. If an excessive current exists for a short length of time, the shunted current flowing through this exposed coil heats the wire and thus sends a larger proportion of the current through the magnet windings, and the circuit breaker acts. Momentary currents, such as occur upon starting the motor, or when it is loaded heavily for an instant, are not supposed to open the circuit breaker. Unfortunately, the feeder soon discovers that the circuit breaker can be adjusted to such a point that it will bother him by operating only at long intervals, and at this point he leaves it. Practically, then, the motor must be protected by fuses which cannot be adjusted. These fuses are of the inclosed cartridge type and are placed in both sides of the circuit, one being located on either side of the main-line switch upon the panel board. The appearance of the controller and panel board can be seen on the press in the foreground of Fig. 3.

By means of a lever and arm which passes through the bottom part of the press the controller can be operated from the opposite side and the press can be run slowly in either direction in "making ready," without tugging at a belt or without the assistance of the feeder. Push-buttons are located at convenient places about the press frames, with circuits connected so as to shunt the "automatic" magnet attachment, and thus the press can be quickly stopped from any one of a number of points in case of accident.

It is needless to point out that such a model printing establishment as has been described would have been impossible with the old method of transmitting power by means of belts and shafting. The successful operation of this plant is such an emphatic argument in favor of the electrical method of operation, that it may be well worth while to review briefly the advantages which have been secured.

The light throughout the plant is entirely unobstructed by belts, so that during the day full benefit is secured of the ideal skylight method of lighting, while at night the operators are not annoyed by shadows, and the amount of artificial illumination required is a minimum.

The predominating idea in the arrangement of the entire plant has been to secure convenience in operation, and the designers of the plant have not been hampered with the necessity of concentrating the machinery near the source of power or of arranging it, in all cases, convenient to long lines of shafting.

The elimination of overhead power-transmitting devices not only takes away the danger of moving belts and revolving pulleys but improves the appearance of the plant, and this is certainly appreciated by the employes, who take pride in the neat appearance of their work rooms.

Without overhead belts and pulleys keeping the dust-laden atmosphere in constant agitation, there is much less waste of stock spoiled by dripping oil or falling dirt—an advantage which it takes a printer to appreciate thoroughly.

The arrangement of the plant over a large area instead of in floors one above another, with belts passing from floor to floor, secures lower insurance rates. The wires running from the engine room to the departments, when once installed, require no further attention. One department may be operated overtime, while the remainder of the plant is at rest. The lighter the load the more efficient become the transmitting circuits, while the opposite is true with belts and pulleys. The number of units in operation in the engine room can be varied to suit the changing demand for power, and thus secure an economy which is impossible with one large engine belted to a main driving shaft.

The absolute control of the presses, with their easy and convenient manipulation when "making ready," and their wide range of speed, allowing them to be run at their fullest capacity, has a great influence in increasing the output of the plant. When a machine is not in operation it is immediately shut down, and there are, therefore, no "stand-by" losses outside of the engine room.

The most important advantage, however, is the saving in fuel. The result of the operation of the new plant is that only about one-third of the amount of coal is burned that was required before the move was made. A part of this saving must be attributed to the design of the power plant, with its modern equipment, so that just how much economy has been gained by the operation of the purely electrical part of the plant cannot be definitely determined.

The Corliss engine was furnished by the Atlas Engine company; the motors by the Sprague Electric company; the motor controllers and starting boxes by the Cutler-Hammer Manufacturing company, and the switchboard and wiring by the Western Electric company, George C. Nimmons was the architect of the building, Bion J. Arnold consulting electrical and mechanical engineer and Thomas Sheehan mechanical superintendent. Much of the success of the enterprise is due to the energetic management of the president of the company, W. B. Conkey.

CORRESPONDENCE.

New York Notes.

New York, November 7.—Considerable activity in electric-railway circles is reported. President Elias, of the Third Avenue Railroad company, says that the lines of the Third avenue system will soon be equipped with the electric conduits. The work of substituting the underground wires for the cable is now being rapidly pushed on the Third avenue line from Harlem to the City Hall, but there will be no stoppage of the operation of the road while the change is being made. President Elias expects that the Boulevard line also will be operated by the underground system within the next four months.

The transfer of a majority of the stock of the Nassau Electric Railroad company of Brooklyn to ex-Governor Roswell P. Flower and other capitalists interested in the Brooklyn Rapid Transit company is now believed to have been completed. This is a practical consolidation of all the surface railroad lines in Brooklyn. The men who are accredited with being behind the deal are large holders of the securities of the Metropolitan Street Railway company and of the Kings County Electric Light and Power company, which recently secured control of the Brooklyn Edison and other allied companies. The consolidation scheme is also said to include the Brooklyn Elevated Railroad company, the Kings County Elevated Railroad company and the Brooklyn City and Newtown Railroad company.

The Brunswick Traction company has opened its new trolley line between Bound Brook and Plainfield, N. J. The distance is 12 miles. Secretary Edward H. Radel of the Brunswick Traction company took the first car over the line. Inside the car were a band and officials of Middlesex, Somerset and Union counties. At Lincoln Mrs. Emma Engel, president of the borough council, stepped to the controller and ran the car through the town. When the car reached the station at Lincoln Mrs. Engel alighted and drove home a nickel spike, which formally completed the line. The public school children of Lincoln attended this ceremony.

It has been decided to begin this month the work of equipping the Lexington avenue and Fifth avenue lines of the Brooklyn Elevated Railroad company with electric motive power.

The October grand jury has indicted the Brooklyn Heights Railroad company for violating the labor laws by allowing its employes to work more than 10 hours in the 24. The indictment was brought about by the Knights of Labor, who some time ago complained to District-attorney Marean that the Brooklyn Heights' employes were being forced to work beyond the legal time. Later the labor people furnished testimony and witnesses, and the matter was brought before the grand jury by Mr. Marean. The indictment charges that on October 17, 1898, William Morey, a motorman on the Gates avenue line, began work at 3:38 p. m. and did not stop work until 2:45 o'clock the following morning. The offense of the street-railway company is a misdemeanor, and it is probable that the trial will soon be brought up in the County Court. A former motorman of the same company, James Cannon, has just secured a verdict of $3,600. Cannon showed that he was motorman on the night of September 4, 1896, that there was a truck across the track and that the brake would not work. In the collison that followed one of his feet was so badly injured that it had to be amputated.

On the mortgage for $10,000,000 recently executed by the Edison Electric Illuminating company of Brooklyn, to secure a bond issue, in the deal with the Kings County company, the war-revenue stamp tax is $5,000.

William A. Eddy, the scientific kite flyer, has been repeating Franklin's experiment on a larger scale on Liberty Island. He sent up three manila paper kites, each six feet in diameter. Suspended from one of the kitestrings was an electric collector five inches square, made of wood, covered with tinfoil. To this collector was attached a copper wire running to within a few feet of the earth. The potency of the collector was determined by the sparks sent out from the earth end of the wire when it was brought almost into contact with another wire attached to a ground plate. Mr. Eddy said: "We sent the collector about 200 feet above the base of the Statue of Liberty. I was surprised at the first spark, as I supposed the immense bronze figure would absorb all the electricity in the air around it within a radius of many hundred feet. When we took the kite line within 30 feet of the statue the electrical action almost ceased. Then when we took the collector 500 feet from the mass of bronze the sparks increased in force and frequency. The electric action was greater than that obtained at Bayonne with a collector four feet in diameter. I judge from my experiments that the seven spikes in the crown of the statue will protect

from lightning an area only about 200 feet in diameter." On another trial, when the collector was 600 feet in the air, or about 200 feet above the head of the statue, the electric action was very strong. A spark half an inch long leaped from the wire to a man's finger tips. M. S.

Northwestern Notations.

Minneapolis, Minn., November 5.—G. Van Ginkel of Des Moines is negotiating a trade by which he expects to come into possession of the Dallas, Tex., street-car system.

The electric-light plant at Clarkfield, Minn., has been completed and put in operation.

It is reported that the electric line running from St. Paul to Wildwood, on White Bear Lake, will be extended to Stillwater, Minn., about eight miles.

Residents of Southeast Minneapolis want a street-car line on Eighth street southeast. They wanted the Como interurban line to come in on Eighth street, but the company decided to come in over the University avenue line. The company is willing to remove the line from its present location to Eighth, but that would be unsatisfactory to a large number of people who want to get to the state university.

J. D. Humiston is enlarging and improving his electric-light plant in Eagle Lake, Minn

Amended articles of incorporation have been filed by the Des Moines Edison Light company at Des Moines, Ia. It is the first step looking to the consolidation of the electric-lighting business in Des Moines.

The special committee on electric lighting at Marshfield, Wis., reported on 23 cities, ranging in population up to 30,000. The price paid per light ranged from $50 for midnight service, and $65 for all-night service up to $95. The plants were partly steam and partly water power.

The mayor of Des Moines thinks the statute requires the street-car company to pave seven feet of street and has vetoed a resolution which orders the company to pave five feet only.

The Fort Dodge Electric Railway company has begun operating street cars in Fort Dodge.

The new electric-light plant at Glencoe, Minn., is to be completed by December 15th.

The enlarged electric-light plant at Rochester, Minn., is now in operation, and the service is much more satisfactory.

W. G. Rowen, city electrician at Rochester, Minn., received a severe shock while untangling wires, by grasping a live wire. He was hurled to the ground, and but for the timely assistance of a bystander would have been seriously if not fatally burned. As it was, his hand was burned to the bone.

The gas company at Spokane, Wash., has sued the street-railway company for an injunction to prevent the latter from using alleged inferior devices, permitting electricity to leak and destroy the plaintiff's pipes by electrolysis.

James H. Selden has resigned as manager of the street-car system in Muscatine, Ia.

C. Masterson has been appointed manager of the Western Union office at Boone, Ia., vice Mrs. Fitzgerald, resigned.

Charles Gundy, a young electrician of West Duluth, Minn., is missing, and foul play is feared.

The Spirit and Okoboji Lakes Rapid Transit company has been incorporated at Spirit Lake, Ia., with $75,000 capital stock, to operate electric lines and furnish light, heat and power.

A judge at Duluth has signed an order permitting the receiver of the street-car company to contract to carry mail.

The resolution to forfeit the unused franchises of the street-railway company at Spokane, Wash., failed to pass, and the company was granted a franchise for a line on Browne street.

The Green Bay Gas and Electric Light company's plant has been transferred to the A. M. Sutherland company of New York, S. Mainland of Green Bay and William Mainland of Oshkosh. Bonds to the amount of $125,000 have been subscribed for and $50,000 will be spent in improvements.

The Merrill Railway and Light company of Merrill, Wis., has decided to rebuild its power station, which was recently burned, immediately. Plans have been prepared for the new structure.

It is reported at Stillwater, Minn., that Thomas Lowry of Minneapolis contemplates establishing an electric street-car line in that city, as well as extending the Wildwood line to Stillwater from St. Paul.

The Duluth Street Railway company is rebuilding and overhauling its rolling stock. The cars for the line between Duluth and Superior have been practically rebuilt and refurnished.

G. M. Fenn has resigned as engineer of the electric-light plant at Boone, Ia., to go to Chicago, and is succeeded by Fred Richardson. A new dynamo has just been installed in the plant.

The Duluth Street Railway company may be sued for $5,000 damages for the death of Arthur Twaddle and Archie Finlayson, two firemen. A hook-and-ladder truck collided with a street car, and the two men were killed.

It is expected to have street-car communication between Hopkins, Minn., and Minneapolis by December 1st. The St. Louis Park line is to be extended, and the materials have been distributed. C.

PERSONAL.

Mr. M. M. Merritt, of the Merritt Electric company, Middleton, Mass., manufacturer of incandescent lamps, was in Chicago this week. Mr. Merritt secured a number of fine orders for his company.

St. Petersburg newspapers announce "the coming visit to St. Petersburg of Thomas A. Edison, the American inventor." It is said that the scientific societies are preparing to give him a brilliant reception.

The marriage of Mr. Josef Henrik Hallberg to Miss Mary Ellen Daley of Salem, Mass., is announced for November 16th. Mr. Hallberg is a young man, but his work in the enclosed-lamp field has already attracted attention. His friends will heartily congratulate him.

City Electrician Ellicott of Chicago has a new office which is larger and pleasanter than the old one. It opens on the north side of the new entrance to the city hall from La Salle street, and will be numbered 14½. It adjoins on the south the city fire-alarm department. The old office of the city electrician is used for an extension of the Bureau of Electrical Inspection.

Camille A. Faure, whose name is familiar to all electrical engineers in connection with the pasted type of storage battery, died a few weeks ago. He was born on May 21, 1840, at Vizille, in the Dauphiné mountains, of an old French family of peasant landowners. After receiving some technical training at the Ecoles d'Arts et Métiers at Aix, he found employment as draughtsman and in superintending the erection of metal works, in various parts of France and in England. It was between the years 1878 and 1880 that his well-known pasted cell was invented, which was subsequently improved by the modifications of Sellon and Volckmar. During later years, M. Faure's attention had been directed toward the solution of various other electrochemical problems, including the manufacture of aluminum, and quite recently he interested himself in the development of the horseless carriage.

LITIGATION.

Judge Hardy, in the Superior Court, at Boston, Mass., October 24th, overruled the demurrers of the Boston Electric Light company and the Metropolitan Construction company, defendants in numerous damage suits growing out of the disastrous subway explosion on Tremont street March 4, 1897. The defendants in these cases claimed that the plaintiffs had not properly pleaded a legal cause of action against them and that they should not be held to answer a trial upon the facts as set forth in the pleadings.

Richard R. Slocum has begun ejectment proceedings against the American Telephone and Telegraph company at Syracuse, N. Y. It is claimed that on July 15, 1889, the company entered upon the premises of the plaintiff and erected poles without his consent or permission along the road upon which Slocum's farm borders in the town of Onondaga, N. Y. He claims ownership to the center of the street. The plaintiff asks that the poles be removed from the premises and that he be allowed damages in the sum of $500.

ELECTRIC LIGHTING.

The contract has been let for an electric-light plant at St. Joseph, Ill., at a cost of $5,000.

The corporation of Monroe, La., is discussing the erection or purchase of an electric-light plant.

The Harper's Ferry (W. Va.) Light and Power company has obtained a franchise for the establishment of an electric-lighting plant.

Johnstown, Pa., has closed a five-year contract with the Johnstown Electric company, calling for 204 arc lights of 2,000 candle power each.

The city of Forsyth, Ga., will hold an election on November 26th to vote upon the proposed issuance of $8,000 in bonds for purchasing an electric-light plant.

The sale of the Nelson, B. C., electric-light plant to the city for $36,000 was declared void by the courts, because Mayor Houston was one of the directors.

The city of Salisbury, N. C., has granted a franchise for electric lighting to F. E. Boardman. The plant will be constructed to be operated by water power.

The Winchester (Va.) Gas and Electric Light company is considering the installation of an arc plant, as has been reported, but definite decision has not been reached.

The City Council of Florence, Ala., has appointed a committee to investigate acetylene-gas, electric-lighting and gas systems in order to ascertain which system may be considered the best and cheapest.

The Edison Electric Light company of Des Moines, Iowa, has been notified by the Board of Public Works to put up arc lights at the Rock Island and the Keokuk and Western crossings, also one on Fifth street below the Chicago, Burlington and Quincy crossing, and one on the Ninth street bridge.

Jule Felton, V. O. Brown and O. K. Brown have incorporated the Montezuma and Oglethorpe (Ga.) Light company, with a capital stock of $3,000, to operate electric and other lighting plants.

Plans are being prepared for the muncipal electric-lighting plant in Fredericksburg, Va. The plant is to have capacity for 72 2,000 candle power arc lights, and its estimated cost is $10,000.

Among the more important of the new industries reported to the Chattanooga Tradesman lately are included a $25,000 electric-light company and a $100,000 electric railway, light and power company in Arkansas.

This item of news comes from Hudson, Mich.: "James Whitcomb, a laborer, has invented a new electric light which Adrian parties, who purchased rights to it, believe will take the place of incandescents. It is smaller, but it is claimed that it gives a stronger light."

Edwardsville, Ill., will have electric light in a few days notwithstanding the complete destruction of its lighting plant by fire. The Leclaire plant adjacent to the city will be connected with the incandescent circuits and the plant at one of the mines nearby will be connected with the street arc lights.

The Healdsburg (Cal.) Electric Light and Power company has commenced suit in the Superior Court for an injunction againt the city of Healdsburg and the Board of Trustees to prevent the city's sale of $80,000 worth of bonds for the purpose of constructing a combined system of water-works and electric lights for Healdsburg. Judge Burnett granted an injunction until the further order of the court.

At a meeting of the Wilkesbarre, Pa., Electric Light company the following-named officers and directors were elected: President, Abram Nesbitt, vice-president, J. W. Hollenback; secretary and treasurer, E. W. Mulligan. Directors, Abram Nesbitt, J. W. Hollenback, E. W. Mulligan, John Flanagan, Liddon Flick, W. P. Billings, E. H. Jones, Charles W. Lee, W. A. Lathrop, E. C. Jones and Irving A. Stearns.

Proposals have been asked for an addition to the electric-light plant at the Cleveland State Hospital, and sealed bids will be received up to 10 a. m., November 16th. The apparatus required includes two 50-kilowatt, direct-connected dynamos, to operate about 300 revolutions per minute; one 10 horse power motor, one 7½ horse power motor and one four horse power motor, two automatic high-speed engines, each to develop 75 horse power.

The contract with the Fulton Electric Light and Power company for lighting the streets of Fulton, Ill., will soon expire by limitation and a new contract is now being considered. The old contract called for 19 arc lights for the sum of $100 a light per annum. The proposed new contract calls for 25 lights at the rate of $88 a year, and $60 for each additional light. The time this contract is proposed to run is nine years and five months from December 1, 1898. As the company's service has been satisfactory, it is believed no trouble will be experienced in renewing the contract.

Bids have been asked by Joseph H. Smith, county clerk of Arapahoe County, at Denver, until 10 a. m., on Monday, November 28th, for the following work, upon the buildings upon the county poor farm, near Henderson in Arapahoe County: A heating plant, complete and ready for operation, for the heating of one main building, two ward buildings and a power house. An electric plant and wiring, complete and ready for operation, for the same buildings. The plumbing complete for the same buildings. The bids must be separate, according to the three divisions named. The plans and specifications are on file with the county clerk at the courthouse, in Denver, and also at the office of Marean & Norton, architects, at 206 Equitable building.

The rumored consolidation of the Potomac Electric Power company with the United States Electric Lighting company of Washington, D. C., is pronounced by officers of both companies to be unfounded. James L. Norris, the vice-president of the United States company, when approached upon the subject, declared that there was absolutely no truth in the statement of the contemplated consolidation of the two companies, and O. T. Crosby, president of the Potomac company, corroborated this denial for his company. It is a fact, he said, that some of the directors of the company had interested themselves recently in the purchase of stock of the City and Suburban railway, but that had absolutely no connection with the Potomac Electric Power company, and they had no idea of consolidating with the United States company.

Consul Lyon writes to the State Department from Hiogo that he has received a letter from K. Ikeda, president of the Kobe Electric Light company at that port, in answer to the consul's inquiries relative to electric-light supplies. The Kobe company formerly used only the Edison lamps, but in 1894 it changed to English and German lamps in consequence of their being cheaper; but it recognizes the superiority of the American lamp, and says

that as it is desirable to use lamps requiring the least amount of power, apparatus for testing lamps is now being put up, which, when completed, may disclose that the company should discard the cheaper English and German lamps and again use the American. The prices are given as follows: Lamps of five, eight, 10, 16 and 24 candle power, 16 cents each; 32 and 50 candle power, 25 cents—this being the cost on delivery at Kobe.

ELECTRIC RAILWAYS.

The State Electric company of Clinton, Iowa, has decided to conform to the state law and vestibule its cars.

The large cars crossing the bridge between Omaha and Council Bluffs will be heated electrically this winter.

It is reported that the Chattanooga (Tenn.) Railway company has determined to extend its trolley system to Smartt's Springs, in the suburbs.

It is reported that the improvements which the Atlanta Railway company contemplates making will cost about $200,000, including the various extensions.

Complaint is made of the noise of the trolleys and wheels of the electric cars in the new Boston subway. A recent writer compares the noise to Bedlam let loose.

A Dublin newspaper, noting the electric-railway expansion of the United States, says that there is a trolley line between New York and Albany, the fare being 25 cents.

David E. Evans & Co. of Baltimore have secured the contract for building a trolley line for the Consolidated Railway company to extend from Mount Royal Station to the western part of Baltimore.

It is reported that the Charleston (W. Va.) Street Railway company has decided to extend its line to Ruffner, W. Va. It is probable, also, that much of the track of this company will be relaid with heavier rails.

It is reported that the company which has been chartered to build electric lines from Cumberland to Frostburg and Westernport, Md., is preparing to begin work. J. W. Burchinal of Moundsville, W. Va., is one of the promoters.

The Peterborough (Ont.) and Ashburnham street railway was recently sold at sheriff's sale to Hazlitt, Bradbourn and Stevenson and the Walsh estate for $20,000. The buyers were members of the company and held judgments against the road for $50,000.

The Northwestern Elevated Railroad company of Chicago is reported to have ordered of Pullman's Palace Car company 33 motor cars and 114 trail cars, to be used on the Northwestern elevated. The cars are to be finished in May, June and July of next year.

The Birmingham Railway and Electric company of Birmingham, Ala., has ordered 12 new cars for its service, which, it is stated, will be among the finest yet introduced into the Southern states. The new cars will be used on what is known as the East Lake division.

The Helena (Mont.) Power and Light company states that the company has under consideration an extension of the electric railroad to East Helena, 4½ miles. New machinery is being set up to accommodate the power which is to be received from the company that has built the Missouri River dam as Canyon Ferry, about 18 miles from Helena.

The temporary injunction issued on Sunday, October 30th, stopping tracklaying in Plymouth court, Chicago, was dissolved on November 2d by Judge Payne. The General Electric Railway company, however, is not clear of legal entanglements, as its rights in the streets in question are to be passed upon by the Appellate Court.

O. T. Crosby, president of the City and Suburban Railway company of Washington, D. C., has been requested by the District commissioners to make a further deposit of $5,000 for the purpose of continuing the work of changing water mains along the line of the road, preparatory to equipping it with the underground electric system.

The commissioners of Carroll County, Indiana, have granted a franchise for the right-of-way for the proposed Logansport and Burlington electric railroad. The franchise was granted to the Business Men's association of Logansport, which has undertaken to organize a company. Some time ago, it is reported, this association secured the franchise for an electric road from Logansport to Rochester, in Fulton County, and later a franchise was granted from Rochester to Winona, in Kosciusko County.

It is announced that next season an electric railway will connect Fox Lake with Lake Michigan. The Chicago and Fox Lake Electric Railroad company has selected a right-of-way touching Lake Michigan at or near Waukegan, and proceeding west near or through Libertyville to Fox Lake, thus enabling resorters to get to the lake from either the Northwestern, St. Paul or Wisconsin Central railroads, which the new road will cross or meet. The capital stock will be $300,000.

A party composed of Dr. J. P. Kimball of New York, A. B. Wood of Tacoma and A. B. Wilse of Seattle reached Red Lodge, Mont., after a two-months' trip to Cooke and adjacent mountains to the south and southwest. The object of the trip was to report on the practicability and advisability of building an electric railroad from Cooke to Red Lodge. Dr. Kimball will submit a report to Dr. J. M. Fox of the Red Lodge coal mines, and should it prove satisfactory the contemplated line may be built.

The Wyandotte and Detroit River Railway company is experimenting with a street-alarm signal at the intersection of Biddle avenue and Oak street, in Wyandotte, where a large electric bell and an electric signal lantern have been placed. The lantern hangs over the middle of the street and the bell is attached to a telephone pole. Electric wires are strung from these over the telephone poles to a point on the trolley wire, some 800 yards away. The connection is so arranged that when the trolley pole reaches that point the bell will commence ringing and the signal light will flash, continuing to warn pedestrians of the car's approach until the latter reaches the point where they are stationed. W. F. Parish of Detroit is the inventor of the signal system.

The councilmen of St. Louis have passed the bill giving the Lindell Railway company franchises for extensions on a number of miles of streets. The bill also gives the Lindell company permission to acquire by lease or purchase all the various systems now operated by it under different names, and the systems known as the Missouri lines and the Forest Park, Laclede and Fourth street lines. These various franchises are all extended to 1942. The city is to receive by way of remuneration the following: For the years 1899 to 1900, $14,000 annually; from 1901 to 1906, $28,000 annually; from 1906 to 1915, $32,000 annually; from 1915 to 1925, a sum equal to three per cent. of the gross earnings; for the next eight years, a sum equal to 3½ per cent.; and for the remaining 10 years, four per cent. of the gross earnings annually.

The Missouri Electric Railway company of Kansas City is organized, with a capital stock of $500,000, one-half paid in, to build a double-track line, starting from Eleventh street and Grand avenue, the center of the retail district, running south and east to the southern city limits on Prospect avenue, about seven miles, where it will connect with a line in Jackson County running south to Dodson, with a branch to Swope Park. Franchise for that part of the road in the county has been granted to the Jackson County Electric Railway company, which is controlled by stockholders of the Missouri company. The combined roads will be 12 miles long, double track. The officers of the company are president, Henry Smith; vice-president and general manager, F. W. Sears; secretary, Chett McDonald; treasurer, B. F. Burd, and general counselor, W. H. Brown.

In regard to the competition of electric lines, President Tuttle of the Boston and Maine railway system believes that the steam roads will have to bow to the inevitable and surrender a portion of their suburban traffic. No matter, he says, how the matter may be viewed, the street railway, within certain limits, has now and will continue to have the advantage over the steam roads. The latter may improve their service as much as they can, but they will find eventually that they cannot compete with the trolley lines, which insure service that the steam roads cannot give, and the latter will therefore have to abandon suburban business within four or five miles of the city. They will have to develop their long-distance service, and can make improvements within a zone of from six to 25 miles, in addition to lowering the longer-distance rates. In this way suburbs will be extended. With such an expansion and attention to through freight and passenger business the steam roads will still have an ample and profitable field of operation.

It is announced that a syndicate, which includes M. E. Ingalls of the Chesapeake and Ohio Railway company; W. J. Payne of Richmond and Samuel Regester of Richmond, has secured control of the electric railroad between Newport News and Old Point Comfort, also the Newport News Electric company, which owns an electric-light and ice-making plant in Newport News. The railroad in question is 14 miles long and has been owned by a company of local capitalists. Its capital stock is $200,000, while there is a bond issue on the property of $230,000. The new company, it is stated, has placed an issue of $800,000 in five per cent. bonds and $400,000 in five per cent. preferred stock. It is understood that the additional capital will be utilized in extending and improving the electric lines and enlarging the electric-light and ice-plant. Some time ago Mr. Payne and others formed another company for the purpose of building an electric railroad between Old Point and Newport News. It is understood that this project will now be given up.

A. C. Frost, vice-president of the Chicago and Milwaukee Electric Railway company, makes the following statement concerning the condition of the company: "Our road will run between Waukegan, Ill., and Chicago, a distance of 30 miles. It is in operation between Waukegan and the southern limits of Highland Park, Lake County, about 16 miles. Work is now being done on the extension south, but we do not expect to have the road completed to Evanston until the early part of next summer. We shall then have on the north shore of Lake Michigan a straight line of 30 miles in length, connecting 15 cities and towns, a most beautiful suburban residence district, having a population of 70,000 people, and with Chicago. A large part of our road is being built on private right-of-way, and we have not a single steam or electric-railroad crossing our entire line. Of the $1,000,000 of bonds authorized, $400,000 are delivered by the trustee upon the company's power plant and the 16 miles of road built and in operation, the balance to be delivered at the rate of 75 per cent. of the actual cost of betterments and extensions. The cost of the road between Waukegan and Highland Park and the franchise which we purchased from the Bluff City Electric Street Railway company is about $510,000. While the road between Waukegan and Highland Park has been under construction all this summer, the gross earnings for the three months ended October 1st amounted to $12,025; operating expenses, $7,672, leaving net profits of $4,353."

PUBLICATIONS.

The Southern Bell Telephone and Telegraph company has issued a neat pamphlet describing the principal features of the service it furnishes and the extent of its territory. This company occupies a splendid territory and gives local and long-distance connections.

A convenient and well-arranged catalogue is that of the Manhattan Electrical Supply company of New York, devoted to electric-light, household, telephone and telegraph supplies. It is completely illustrated, and prices are given. An index adds to the value of the book.

C. Olivetti of Ivrea, Italy, issues a well printed and well illustrated catalogue of electrical instruments. With it he encloses a price-list printed in English that is a little queer in spots. Thus American customers are told that "For ordees amountig to Dollars 200 or more prices are intended for goods f. o. b. New-York or Hoboken custom not included."

George W. Patterson of Chicago reports a great demand for his jubilee souvenir, "History of the Spanish-American War, with Handy Atlas Maps," and now extends a cordial invitation to those handling or using American Circular Loom flexible conduit, Boston electroduct steel tube, Gordon or Law primary batteries, Welsbach or New Era electric gas lighters or Standard knife switches, to call at his office in the Marquette building and secure a copy of the work.

The American Electrical Heater company, 197 River street, Detroit, Mich., has issued a neat price-list and illustrated catalogue of its various electrical heating devices. As is well known, this company manufactures electrical soldering irons, laundry irons, tailors' irons, curling-iron heaters, heating disks, electric air heaters and other specialties. The company claims that it makes heating devices that are not only efficient but durable as well, and guarantees every device it makes. All those interested in heating devices will be pleased with the American company's catalogue.

In an elaborately illustrated brochure the E. W. Bliss company of Brooklyn gives views of its works. The company has a wide reputation as a manufacturer of sheet-metal-working machinery, and employs over 800 men. One paragraph of the introduction of the pamphlet is particularly interesting: "Copies of our designs, some of them so close as to include the details of shading in our engravings, have been made in all countries where sheet-metal tools and stamping machinery are manufactured. Inasmuch as 'imitation is the sincerest form of flattery,' we have no objections to raise against these acknowledgements on the part of our competitors of the superior features of our designs, but it may not be inappropriate to remind buyers that the spirit which prompts slavish imitations is not liable to abound in such mechanical understanding as will give to all details their proper execution, nor in such mechanical honesty as will provide for the very best workmanship and materials. Copies of many of our most successful machines have proved utter failures, and no case has come to our knowledge of a copy equaling our originals in efficacy, durbility and accuracy. The improvements which we are constantly making in the design and details of our tools make it impossible for even the closest copy to represent our most recent results. As for European imitators, they labor under the additional disadvantage of not having the same materials to work with. The special mixture of American cast-iron which we employ is 35 to 50 per cent. stronger than the machinery iron obtainable in Europe, and therefore lends itself to forms which it would there be out of the question to adequately reproduce."

NEW INCORPORATIONS.

The People's Telephone company was incorporated recently at Worcester, Mass., with a capital

stock of $150,000, by I. L. Currier, H. W. Aiken, C. H. Sanborn and others.

The Abbott Electric and Manufacturing company of Cleveland was incorporated with capital stock at $15,000 by H. H. Hammond, H. I. Wickes, William A. Marback, S. Abbott and C. B. Abbott.

The People's Telephone company of Lockport, Ill., has been incorporated with capital stock at $12,000. The incorporators are Allen G. Hawley, Charles B. Cheadle and Thomas A. Cheadle.

The Brotherhood of Electricians and Linemen of Illinois has been incorporated at Springfield, Ill., without capital stock, for mutual benefit. The incorporators named are W. H. Sammons, R. L. Flannigan, S. H. Phillips.

Among recent incorporations at Springfield, Ill., was that of El Porte Zuelo Light and Power company of Chicago, with capital stock fixed at $500,000. The incorporators are Chester D. Crandall, William M. Carpenter and William R. Patterson.

The Waterbury Battery company has filed a certificate of incorporation in the office of the state secretary of Connecticut. The capital stock is $10,000, divided into 400 shares. The directors are C. Platt, Charles B. Schaumacht and C. M. Platt.

The Kenton Telephone company, with $30,000 capital, has been incorporated at Columbus, Ohio, to operate a telephone system from Kenton to Marion, Marysville, Bellefontaine, Wapakoneta and Lima. The incorporators are Ed L. Barber, James S. Brailey, J. C. King, C. E. Guilford and Horton Park.

The Tuscarawas Home Telephone company, with headquarters at New Philadelphia, Ohio, and a capital stock of $75,000, has been incorporated by J. S. Bailey, F. W. Bainbridge, J. W. Yeagley, O. S. Welty and J. H. Mitchell, to operate a telephone system between New Philadelphia, Canal Dover, Urichsville, Dennison, Canton, Carrollton, Cadiz, Cambridge, Coshocton, Millersburg, Wooster and neighboring towns.

Three charters were recorded at Chester, Pa., recently in the office for recording deeds. They were the Darby-Landsowne Electric company, Clifton-Lansdowne company and Yeadon-Lansdowne company, which were formed for the purpose of furnishing heat, light and power. Those interested are: T. P. Street, H. C. Stanlell, M. J. Kelly, J. M. Lutz, R. Shoemaker, E. T. Bishop, N. J. Mitchell and E. B. Lewis.

A new telephone company has lately been incorporated in Wisconsin, under the name of the Spring Green and Wyoming Telephone company, with a capital of $1,000, divided into 30 shares, the incorporators being the Hon. R. L. Joiner and James L. Jones of Wyoming in Iowa County, and Thomas W. King of Spring Green, Sauk County. The officers are Hon. R. L. Joiner president, and Thomas W. King secretary and treasurer.

ELECTRICAL SECURITIES.

Chicago Telephone stock paid its regular monthly dividend of one per cent. on November 5th.

The Quincy Street Railway company has filed a mortgage for $500,000 in favor of the Portland Trust company to secure an issue of bonds for the same amount.

At the New State Telephone directors' meeting last month, the third quarterly dividend of two per cent. was declared, payable November 15th, to all stockholders of record October 31st.

The quarterly report of the Brooklyn Heights Railroad company to September 30th shows gross earnings $1,664,931, increase $249,745; net earnings $705,885, increase $109,472; total income $727,857, increase $69,844; surplus $197,001, increase $105,443.

The Brooklyn Rapid Transit company's passenger earnings for October amounted to $509,629, as compared with $443,923 in October of last year. For three months to October 31st the earnings were $2,168,231, and for the same period of 1897 they were $1,853,721.

The Paducah (Ky.) Street Railway, Power and Light company has filed a trust deed with the county clerk in favor of the American Trust and Savings company for $400,000. This was done to enable the street-railroad company to issue additional bonds, if desired.

The Edison Electric Illuminating company of Boston has changed its fiscal year to end with June, and for six months reports gross earnings of $488,964; expenses, $306,850; net, $182,113. The balance sheet shows: Cash on hand, $106,846; profit and loss surplus, $25,343.

The quarterly report of the Long Island Electric Railroad company to September 30th shows gross earnings of $193,620, increase $30,603; net earnings $15,633, increase $3,054; total income $17,376, increase $2,314; net income $6,983, decrease, $852. The general balance sheet shows cash on hand $591, and a profit and loss surplus of $6,989.

The consolidation of the Fairhaven and Westville railroad and the New Haven street railway is completed. The terms of the transfer provide for the doubling of the $900,000 capital stock of the Fairhaven company and the addition of $200,000 new stock, to be turned over to the New Haven Street Railway company, with $500,000 in cash. Each stockholder of the Fairhaven road has his stock doubled.

The Union Railway company of New York city reports for the quarter ended September 30th, gross earnings of $193,620, increase $30,603; net earnings $89,123, increase $800; total income $89,289, increase $7,800; net income $49,780, increase $3,486. The general balance sheet shows cash on hand of $40,051, and a profit and loss surplus of $406,570.

The People's Telephone company of Wayne and Monroe counties held its annual meeting at Carleton, Mich., on October 25th, and issued a dividend of 10 per cent. to stockholders. The following-named officers were elected: President, Joseph Waltz; secretary, F. L. Edward; treasurer, W. S. Morey; directors, T. J. A. Milliken, Jesse Butler, Joseph Waltz, F. L. Edwards, W. S. Morey and Benjamin Hall.

The Southern New England Telephone company has authorized a new loan of $1,000,000 gold five per cent. 50-year bonds, of which $600,000 will be used to retire within the next three months $500,000 of old first-mortgage debt and also to pay $100,000 of floating indebtedness. The rest of the new loan will be issued and used as needed, to expand the plant of the company. Old bondholders are offered the new bonds at 109 in exchange for their bonds at 102. The new loan will be a first mortgage, and has been underwritten by New Haven bankers.

It is announced that the net result of the reorganization of the New Orleans Traction company will be a reduction of $200,000 per annum in the company's fixed charges. The $1,500,000 of six per cent. collateral trust notes will be exchanged for an equal amount of new five per cent. preferred stock and 50 per cent. of new common stock. The $3,000,000 of five per cent. City and Lake bonds will not be distributed, but the $3,000,000 Crecent City railway five per cent. bonds will be replaced by a new mortgage for $3,250,000, of which the old bondholders get $3,000,000 and $250,000 will be reserved for improvements and extensions. These bonds will bear four per cent. interest for five years, and then five per cent., thus saving $30,000 a year. The holders of stock in the underlying City and Lake line are to receive $685,000 in new preferred stock, which is 110 per cent. of their present holdings, and 25 per cent. in new common stock. The Crescent City, minority stock is to receive par value in new common stock for the $347,000 now held. The holders of the old common stock are to be assessed $3 a share and the holders of preferred $6 a share. Old common stock will be exchanged for 22½ per cent. of new common and old preferred will be exchanged dollar for dollar of new common. New preferred will be issued for the assessments. The amount of new common stock will be $5,000,000 and of the new preferred $2,500,000.

MISCELLANEOUS.

One estimate places the total investment in electrical appliances and electrical businesses in the United States at $1,900,000,000.

Mortimer E. Gilbert of the Chicago office of the Postal Telegraph company says that lightning flashed from a clear sky on November 4th and did considerable damage to telegraph and telephone wires at the stockyards.

The seventeenth annual ball of the Chicago Association of Stationary Engineers will be given in Masonic Temple Hall on Thanksgiving Eve, November 23d. George E. Van Tassel is chairman of the committee of arrangements.

The following advertisement appeared in an Ohio newspaper last week: "Wanted—By the —— Incandescent Lamp company of ——, Ohio, 50 girls, 16 to 24 years of age, who desire steady employment. —— is a desirable town for the residence of families having girls who desire employment."

A contemporary notes that an important extension in the applicability of aluminum has been attained by the discovery that a thin coating of copper, which does not add appreciably to the weight of the aluminum, enables it to be bent and folded, soldered, tinned or nickeled without any cracking or other disadvantage. Both wire and plate in coppered aluminum have been successfully produced.

The Board of Aldermen of Denver granted a franchise to the Denver Power and Irrigation company recently, empowering the company to erect poles, string wires and build conduits for the purpose of transmitting electricity into Denver for light, power and heat from its proposed transmission plant to be erected at the head of Platte Cañon. It is estimated that an outlay of approximately $2,000,000 will be necessary to complete this plant. Work is to be commenced at once. Rhodes Bros., Equitable building, Denver, are the promoters of the enterprise.

A peculiar accident happened in Chicago a few days ago. Alexander Lang climbed to the roof of a Cicero and Proviso electric car at Forty-eighth avenue and Lake street, bestrode the trolley pole, which had been pulled down, and started to make some repairs. In some manner the fastening of the pole was released and the powerful spring at its base sent pole and man astride it flying skyward. Lang soared off over the edge of the roof and fell head first in a ditch 20 feet away. He was in danger of being suffocated in the mud when Conductor Herman Johnson seized his heels and drew him out unhurt.

The jury which tried L. D. Jamieson before Judge Waterman of Chicago announced its inability to agree and was discharged. Jamieson was tried on a charge of larceny. He was alleged to have had unlawful possession of a certificate of stock for 50 shares, valued at $5,000, in the St. Louis Electric Construction company. Some months ago Alderman George P. Heckel of St. Louis applied to Charles Sutter for a loan of $750. He was given the stock certificate to negotiate for a loan of not less than $2,500, and placed it with L. D. Jamieson & Co. It is said that Jamieson has refused to surrender the certificate on the ground that Heckel is indebted to him. The prosecution averred that Heckel never had any right of possession in the certificate.

General John M. Wilson, the chief engineer officer of the army, in his annual report to the secretary of war, estimates that in the coming year $100,000 should be spent for torpedoes for harbor defense, for the purchase of submarine mines and necessary appliances to operate them, for closing the channels leading to the principal seaports, for needful casemates, cable galleries, etc., to render it possible to operate submarine mines, and for continuing torpedo experiments. The following is an interesting paragraph of the report: "While no hostile attacks were made upon our coasts during the war with Spain, the operations of the American fleet on the coasts of Cuba and Porto Rico have amply demonstrated the value of coast defenses, including shore batteries and submarine mines, in resisting naval attacks. It may be confidently asserted that the completion of the projects upon which operations are now in progress will practically insure the safety of our principal harbors and seacoast cities against any attack from the sea."

TRADE NEWS.

David Reckard (late of Ohio) has established works for the manufacture of dynamos and other electrical appliances at Suffolk, Va.

In Dallas, Texas, the Sutton-Steele Electrical Manufacturing company has been organized. The company is incorporated and has a capital stock of $20,000. It is to manufacture electric fans, motors and other electrical supplies. The incorporators are Walter L. Steele, Henry M. Sutton and J. L. Sale.

A telegraph operator, the manager of a small western office, writes to the Telegraph Age to say that he has sold over $3,000 worth of electrical apparatus in the last four months. He uses his leisure time to supply the electrical needs of the neighborhood. There may be an idea in this for electrical manufacturers and supply men to consider.

The L. M. Rumsey Manufacturing company, dealing in machinery supplies at St. Louis, Mo., has just established a connection with the Shelby (O.) Electric company, through which the former company will handle Shelby lamps in the western territory. The L. M. Rumsey Manufacturing company has 14 salesmen on the road, and proposes to push most energetically the incandescent-lamp branch of its business. It is said also that the Rumsey company will handle other electrical goods. In addition, the Smith-Courtney company of Richmond, Va., another large handler of heavy machinery and machine supplies, is also pushing the sale of Shelby lamps throughout the South.

The electrical trade in general, and particularly those doing business in that territory of which Cleveland is the center, will be interested to know that the Westinghouse Electric and Manufacturing company has established a branch office at 1310 New England building, Cleveland, with C. S. Powell as manager. This change was made necessary by the absorption of the Walker company. Mr. Powell has represented the Westinghouse company for some time in the Cleveland territory and has been so energetic and successful in furthering his company's large interests that his appointment to take charge of this branch office will not be much of a surprise to his friends. The Cleveland branch will attend to business in Northern Ohio and along the Lake Shore railroad.

During the last summer the Joseph Dixon Crucible company of Jersey City, N. J., has added an extension to its pencil factory, 40 by 90 feet, three stories high. This extension is driven by electric power from a generator placed in the main factory. No expense has been spared in the equipment of this addition in the way of up-to-date elevators, furnace, dry-rooms, etc. The company will also put down an artesian well, several hundred feet in depth, for a supply of water for factory use, and sometime during 1899 various other additions will be built to the Dixon company's very extensive plant. The company was established in 1827, but during all of its more than three-score years and 10 of busy life, no year has in any way equaled 1898 for volume of business; its plant has been running

continuously, yet the company is behind its orders in all departments.

A transformer said to be thoroughly up-to-date and to cover every desirable feature of economic distribution which experience has thus far suggested in the construction of transformers is the Moloney transformer, for which the Western Electrical Supply company of St. Louis, Mo., is the general selling agent. Within the last year need of an improved system of distribution has been daily pressed upon the attention of those in charge of central stations; the importance of an increased operating efficiency in transformers has become plainly evident to them, and a closer investigation of the defects of many of the existing systems has been generally instituted. Such investigation has never been discountenanced by the best transformer builders, and it has been the constant endeavor of responsible manufacturers to promote the spirit of inquiry—a course which has suggested itself to them as the most direct and effective way of excluding from the field of competition all inferior and defective manufactures. The Western Electrical Supply company claims that the Moloney transformers embody all that is latest and best in the art of transformer building—a fact that has been established by the many severe tests to which the transformer has been subjected. The manufacturer of this transformer claims that it has never been defeated in any competitive test, and confident of its further success, the Western Electrical Supply company invites a close examination and comparison of its merits, and will take pleasure in furnishing a transformer bulletin showing how to conduct a thorough test on transformers.

BUSINESS.

The Western Electric company has distributed a bulletin giving a full description and price-list of the Western Electric non-sparking brushes. These brushes are very satisfactory in eliminating the sparking at the commutator. Upon request a copy of this bulletin will be sent to anyone who has not received one.

Send four cents (in stamps) for an illustrated booklet issued by the Chicago, Milwaukee and St. Paul Railway company, operating the direct route across the American continent to the new transpacific possessions of the United States. The booklet is full of latest reliable information and valuable for reference. It can be used as a textbook in scool. Address George H. Heafford, general passenger and ticket agent, Chicago, Ill.

The Berlin Iron Bridge company of East Berlin, Conn., is erecting for the United Gas Improvement company, Waterbury, Conn., the steel work for a generator room and an engine room. These roofs are to have steel trusses, supporting the roof covering. This covering is corrugated iron, lined with the Berlin Iron Bridge company's patent anti-condensation fireproof lining. The engine room has a span of about 33 feet, and the span of the generator room is about 51 feet.

One of the greatest problems which presents itself to every electric-light station manager is the porper protection of electrical machinery from damage by lightning. Anything leading to a proper solution of the problem is always welcome. The Electric Appliance company has just issued a special circular of Wurts' lightning arresters, which embodies all of the improvements to date in this class of apparatus and gives some valuable hints with reference to protection from lightning.

The America water motor of the A. Rosenberg company of Baltimore is said to run on ordinary house pressure of 20 pounds or over. It will never rust, it is claimed, and is useful, among other things, for operating moving figures in show-windows where electric current cannot be had. It is also claimed to be the only water motor that will not leak at the bearings.

The Western Electrical Supply company of St. Louis, Mo., has just issued and is sending out to the trade a neat and attractive card 12 by 18 inches illustrating in red and black its Perfection annunciator. This card is in the form of a folder, which, when opened, is so arranged as to hang on the wall or any other convenient place. The Perfection annunciator has double magnets and all cases are highly polished and made to correspond with the latest design of architecture. The simplicity of this annunciator is one of its best features, as there is no possibility of its becoming loosened and out of adjustment. It is especially recommended for factories, mills, cars, steamboats and other places where there is a constant jar, which is one of the most severe tests an annunciator can receive. The company's elevator annunciators are also worthy of mention. They are made in two styles of cases, and are ornamental as well as reliable. Those who are familiar with elevator annunciators will readily recognize the fact that it is difficult to keep such an appliance in working order, without numerous repairs. The Western Electrical Supply company has a large stock of these annunciators on hand and can make prompt shipments.

ILLUSTRATED ELECTRICAL PATENT RECORD.

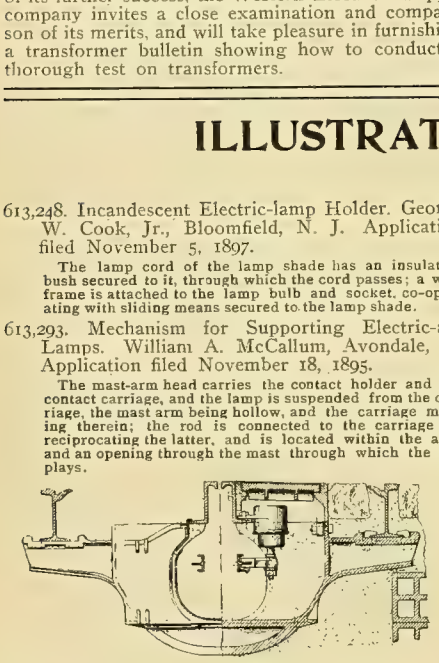
Issued November 1, 1898.

613,248. Incandescent Electric-lamp Holder. George W. Cook, Jr., Bloomfield, N. J. Application filed November 5, 1897.

The lamp cord of the lamp shade has an insulating bush secured to it, through which the cord passes; a wire frame is attached to the lamp bulb and socket, co-operating with sliding means secured to the lamp shade.

613,293. Mechanism for Supporting Electric-arc Lamps. William A. McCallum, Avondale, O. Application filed November 18, 1895.

The mast-arm head carries the contact holder and the contact carriage, and the lamp is suspended from the carriage, the mast arm being hollow, and the carriage moving therein; the rod is connected to the carriage for reciprocating the latter, and is located within the arm, and an opening through the mast through which the rod plays.



NO. 613,301.

613,301. Yoke for Railway Conduits. Fred S. Pearson, Boston, Mass. Application filed November 4, 1897.

A yoke for railway conduits is described having a hollow central portion and detachable manhole curbs flush with the surface of the roadway.

613,309. Electric Ignition Device for Internal-combustion Engines. Louis W. Ravenez, Paris, France. Application filed March 7, 1898.

An electric ignition device for internal-combustion engines comprising a conducting wire in an insulating core provided with a metallic sheath having a depending wire, the ends of the wires being connected by a platinum wire, the whole being adjustable in a stuffing-box secured to the wall of the cylinder, and means for adjusting the position of the ignition device.

613,348. Printing Telegraph. Aloys Wirsching, New York, N. Y. Application filed May 10, 1897.

One claim is given: In a printing-telegraph instrument the combination of a guide or shaft held against endwise movement, a carrier adapted to travel to and fro lengthwise of said guide or shaft, a type wheel and connections between the same and said carrier, whereby the type wheel moves in response thereto, and means for moving the carrier along the guide or support, said means having its line of draft coincident with the axial line or center of said carrier.

613,357. Suspension for Electric-railway Motors. William Cooper, Cincinnati, O. Application filed August 16, 1898.

A motor is sleeved to the driven axle in combination with a pair of supports therefor engaging the sides of the motor at points located between the driven axle and the center of gravity of the motor.

613,367. Electric Rotary Cutter. Fulton Gardner, Chicago, Ill. Application filed March 19, 1897. Renewed January 24, 1898.

A combined standard and peripheral guard extends around the rear and top edges of the cutter, an electric motor having an exterior rotating part, a rotary cutter mounted upon the periphery of the exterior rotating part intermediate between the ends thereof and means for supporting the motor from the upper portion of the guard beyond the ends of the exterior rotating part.

613,406. Electric Car Lighting. William Biddle, New York, N. Y. Application filed May 14, 1894.

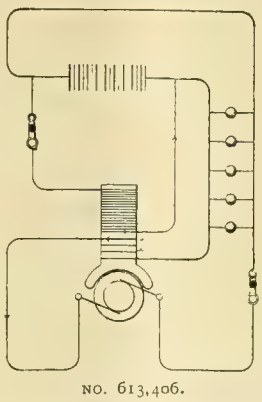
The dynamo has an armature rotated by a connection to the car axle with an external circuit from the commutator containing incandescing lamps in multiple arc, a secondary battery in series in the external or working circuit, a helix of the field magnet in a shunt to the secondary battery and a reverse-wound helix in the main circuit for unifying the action of the dynamo under varying speeds of rotation of the armature.

613,418. Electric Railroad. Charles L. Kemery, Pittsburg, Pa. Application filed January 12, 1898.

This electric railway system comprises a conduit having feed wires arranged in the bottom thereof, angular strips of insulating material in flange spaces along the upper edges of the conduit, conducting plates resting on the insulating strips and insulated from each other, U-shaped brackets suspended from the insulating strips and extending beneath the contact plates, insulators located in the vertical arms of the brackets, conducting strips susceptible to magnetism supported in the brackets, non-magnetic plates of conducting material connecting the conducting strips, conductors connecting the feed wires with the conducting strips, a car, contact rollers journaled therein to bear on the conducting plates, and an electric magnet mounted on the car directly above the conduit and suitably connected with the contact rollers to be energized by the current therefrom for the purpose of attracting the conducting strips into contact with the conducting plates.

613,420. Electric Vehicle. Karsten Knudsen, Chicago, Ill. Application filed June 18, 1897. Renewed September 21, 1898.

A vehicle frame is described comprising a rear axle, upwardly extending brackets mounted thereon, a pair of longitudinal tubes secured in the brackets, a cross piece, an electric motor frame journaled to the rear axle and resiliently suspended from the cross piece, a cross piece joining the longitudinal tubes at the forward end of the frame, a center bracket upon which this cross piece is supported, tubes extending laterally from the center piece each carrying brackets upon the ends, and a pair of axles mounted upon the brackets to rotate about vertical axes.



NO. 613,406.

613,433. Electric-railway System. Louis E. Walkins, Springfield, Mass. Application filed November 18, 1897.

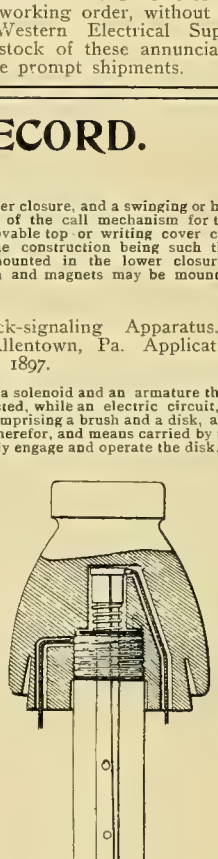
The system includes a line or feed conductor, a generator connected therewith, and a return conductor, two series of contact switches, the fixed member of one being connected with the return conductor, and having the location in a line parallel with that of the other series, but relatively intermediate thereof, together with the car having the motor thereon and the two underlying longitudinal horizontal runners.

613,533. Telephone Box or Cabinet. Ishmael Sparks, Santa Fé, New Mexico. Application filed March 22, 1898.

A box is mounted upon the front of the backboard and is provided with a partition for forming an upper and lower closure therein, a removable front board or door for the lower closure, and a swinging or hinged front carrying part of the call mechanism for the upper closure, and a removable top or writing cover closing the upper closure, the construction being such that the batteries may be mounted in the lower closure while the call mechanism and magnets may be mounted in the upper closure.

613,567. Block-signaling Apparatus. Taylor T. Fogel, Allentown, Pa. Application filed December 6, 1897.

A target, a solenoid and an armature therefor are pivotally connected, while an electric circuit, a circuit closer therefor comprising a brush and a disk, a solenoid and an armature therefor, and means carried by the second armature directly engage and operate the disk.



NO. 613,594.

613,594. Electrical Fuse-wire Holder. William D. Packard, Warren, O. Application filed September 29, 1897.

A visible fuse cut-out comprising, in combination with an insulator having terminals, a casing projected outwardly from the insulator and having a cap, a fuse-wire and a pendant holder therefor located in the casing and projected beyond the inner end thereof, the wire being placed in circuit with the terminals when the casing is forced home in the insulator.

613,612. Electric-railway System. Louis E. Walkins, Springfield, Mass. Application filed May 20, 1898.

In an electric-railway system there are the car-track rails, intermediate conductor rail sections, corresponding conductor rail sections near and outside of one of the track rails, and a continuous guard, interposed between the conductor rail sections and the adjacent track rail which is extended above the top of the sections, feed and return wires having wiring-in connections respectively with the intermediate and outlying conductor-rail sections.

613,647. Insulator for Incandescent Electric Lamps. Charles W. Brown, Boston, Mass. Application filed December 15, 1897.

The reversible insulator described is formed of non-conducting material internally threaded, having about centrally a thickened peripheral ring and at either side thereof thinner end portions projecting longitudinally from and of less diameter than the ring.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, NOVEMBER 19, 1898. No. 21

Innovation on Chicago Trolley Lines.

With the opening of the Wentworth avenue line in Chicago for regular traffic an innovation will be made by placing in service a vestibuled train consisting of a motor car for smokers and a regular coach as a trailer. The accompanying illustration gives an excellent idea of the appearance of the train, which is certainly up-to-date in every respect.

The motor car is a remodeled grip car, enclosed entirely in the front and on the sides, entrance being gained at the rear from the platform of the trailer. There are no side doors and no steps on this car, as it is intended to have the conductor on the trailer collect the fares on the motor car. It is believed that this can be readily arranged, as only two or three trips would be made during the rush hours of the day, and passengers who would utilize the smoker at such times would in all probability go a considerable distance, and during the rest of the day no trouble is anticipated. This would obviate the necessity of putting a conductor on the smoker. If the experiment proves successful and popular the company may equip all of its electric lines where the traffic warrants the change.

There are several features about this train which, while not exactly experimental, are not in general use in Chicago. It will be noticed, first of all, that the motor car is equipped with a fender. This particular type is furnished by the Consolidated Car Fender company of Providence, and is composed of two distinct parts, the cradle and the cushion. The cradle is six feet wide, three feet long, and is formed of curved steel ribs parallel to the axis of the car. The back of this cradle is hinged to the front of the platform with trunnions, so that it may be turned up against the dash, or may rest with its front edge on the track, or may occupy any intermediate position. The front edge of the cradle is formed of a steel rod passing through the ends of the curved ribs, which are bent to clasp it. On this rod are rubber rolls, 1¾ inches in diameter, between the ribs. A steel bar projecting to the rear under the platform holds the cradle at any desired height by means of a latch or trigger, which, being pressed with the foot, releases the cradle so that its front edge drops to the ground. The cushion is a resilient shield, made of carefully tempered steel bands, which covers the iron bumper and all other projecting parts of the platform, so as to afford protection in case a person is struck by a fast moving car. The cushion is hinged to the cradle so that the two form one fender, which may be removed from one end of the car to the other.

INNOVATION ON CHICAGO TROLLEY LINES.

The most important departure from common practice is the employment of wooden trucks. Similar equipments have been in use under several cars on the lines of the Chicago City Railway company during the last few years. They were designed by Charles E. Moore, the master mechanic of the company, and built under his supervision. They have been adopted by the management as the standard truck for the system, and the new cars now being built will be equipped with this type.

The smoker has electric lights and electric heaters, as it will be used on trolley lines only, but the trailer is provided with gas as well as incandescent lamps, and will be heated in the same manner as the cable trains, by a self-feeding coal stove designed for this special service by President Bowen when he was superintendent of the road. All the regular coaches of the Chicago City Railway company are thus equipped, so that they can be used on the cable lines or as a part of the trolley system.

Another excellent feature of the arrangements is the plan adopted for ventilating the cars. This has been found to be one of the most difficult problems encountered in street railway operation. With the old-fashioned method of hanging the ventilating windows like shutters it was found that the jarring of the car frequently closed them, or that they were shut by passengers who objected to the direct draught upon their heads. In the smoker and trailer under consideration all ventilators are controlled by a sliding rod which may be operated by a handle at each end of the car. Instead of being raised, the ventilators are swung on a pivot, one end projecting into the car and the other forming a collector for the air. By this arrangement, it is claimed, a much better circulation of air can be obtained in all parts of the car without causing a disagreeable draught in any particular part.

The idea of transforming the grip car into a motor car and inclosing it for smokers was suggested to Mr. George O. Nagle, the superintendent of the company, by the crowded condition of the front platforms on some of the trolley lines. The special features of the equipment are likewise due to Mr. Nagle.

Paris Exposition of 1900.

With the return of Commissioner Peck to this country it is expected that much information concerning the Paris Exposition will be obtainable and that interest in the great exhibition of 1900 will be stimulated among American manufacturers. Commissioner Peck went to Washington immediately upon his arrival in this country and he has not yet reached Chicago. It is announced, however, although not officially, that he succeeded in obtaining more than 40,000 additional square feet of space for American exhibits. This gives a total of 210,000 square feet exclusive of the ground for the United States government pavilion, in which agricultural implements and an American vestibuled train, with locomotive attached, will be exhibited. In addition to this, Commissioner Peck has secured space at Vincennes, 10 miles from Paris, for a practical exhibition of road rollers, traction machines, and threshing machines.

The assistant commissioner-general, Professor B. D. Woodward, is now in charge of the permanent office of the American commission in Paris. Permanent offices have also been opened in the Equitable building at 120 Broadway, New York. The headquarters of the commisison are at the Auditorium, Chicago.

Thus far little attention seems to have been given the details of the electrical features to be presented. The rear end of the Champs-de-Mars, says l'Electricien, at the back of the Palace of Electricity, has been selected for a grand display of luminous cascades, being the main entrance to the electrical building. The structure has been designated the grand Château-d'Eau, and it promises to become one of the "keys" to the exposition of 1900. Placed in the transverse axis of the power room, it will have not less than 127 meters of façade, without counting the piazzas 12 meters in width, leading to galleries which are 140 meters in length.

A grand arcade is to serve as foyer to a niche 30 meters wide and 10 deep, forming the principal motive of the composition; this will enclose a vast receptacle, whence an abundant flow of water feeds the successive basins and water cascades, and an enormous laughing waterfall will precipitate itself, a dozen meters wide, from the keystone of the arch, reminding one of the wild cascades of the Pyrenees. One may have some conception of the grand beauty of this view, when it is stated that the quantity of the sparkling fluid discharged will be about 2,000 liters per second. This water, taken from the Villejuif reservoirs, was originally intended to flow into the Seine, but a second project, now being considered, is to return it to its head, and thus use it continuously.

A beautiful group, 12 meters in height, occupies the middle of the central arcade, representing the Genius of Progress trampling the Past underfoot and leading Humanity toward a brighter future. Surrounding this grand niche colonnades, set off with statuary and graced with water effects, support an arch pierced with generous openings, whence spring sirens, naiads and mythological personages, while at the foot and before the grand cascade, strewn among vases, are statues and fantastic animals, spouting or receiving the crystal waters.

An immense cartouche of the arms of the republic, borne by heroic figures, forms the keystone of the grand arcade, and is crowned by the hull of an overturned vessel, with water rushing through it. At the right and left of these streams and directly behind them, two passages, at an angle of 45°, lead to the vestibule of the Château-d'Eau, which may be considered the entrance to the Electricity building. Finally, the whole composition will be completed by galleries leading to the right and left, and at the return angles will be found passages at 45°, similar to those already mentioned. These return passages terminate in two pavilions in an outer court.

Every idea which could add picturesque and grand effects seems to have been embodied in the designs and execution of this magnificent work. Roomy staircases permit of gradual access to the second floor of the Palace of Electricity. Back of the Château-d'Eau, adroitly hidden in the circular pavilions and in the grand central niche, commodious stairways will permit of vast numbers of visitors to circulate freely along the different levels, so arranged as not to interfere with the general effect, and, finally, along the wide stairways, pretty little cascades will hide their sparkles in the emerald grasses or among the gay blossoms of the mossy borders.

Death of Latimer Clark.

Latimer Clark, C. E., F. R. S., died in Twickenham, England, on October 30th at the age of 76 years. Mr. Clark became connected with the telegraph industry in 1850. He introduced many improvements in the art of telegraphy. In 1860 he was a member of the commission appointed to inquire into the question of laying and operating submarine telegraph cables. From that time on he was prominently associated with submarine telegraphic enterprises. For 10 years he was in partnership with Sir Charles Bright, and it is said of him that he was connected with the submergence of some 100,000 miles of submarine cables in all parts of the globe. In conjunction with Sir Charles Bright he read a paper before the British Association, in September, 1861, putting forward a definite system of electrical measurement in ohms, volts and farads, which practically forms the basis of modern electrical scientific measurement. It was this paper which led to the formation of the British Association committee on electrical units, which since that date has done much useful work. Mr. Clark was perhaps best known as the inventor of the standard cell which bears his name.

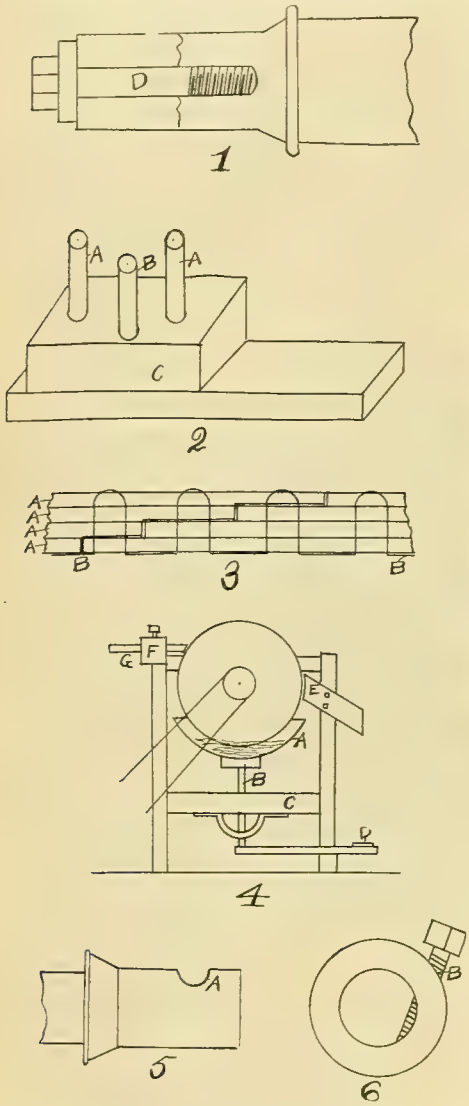
Hints for the Electrical Mechanic

By B. F. Fells.

Perhaps it will be useful to some one if I note the plan of repairing a singular break on a motor which was recently found of value. A bar axle broke off at the boss. We went to work with a lathe with a hollow spindle, fitted with a three-jawed chuck on the head-stock and chuck for drilling. After the hole had been drilled a bushing, one size smaller, was driven into the chuck to serve as a guide for one end of a boring bar to work into. This bar was only a round bar of steel, turned down to a running fit for the bushing at one end, and was run off small enough at the other end to set in the drill chuck at the dead center. With this arrangement a hole was drilled straight through the spindle and a stout bolt was put in, in the way shown by D in Fig. 1. The bolt was tightened, and a complete union was made.

Bending Tubes.

There is always more or less bending of tubing to be done in connection with the repairs of electrical machinery. It is common to fill the tube before bending. In some cases a mixture of resin



HINTS FOR THE ELECTRICAL MECHANIC.

and Trinidad pitch is used for filling the tubes. Paper pulp may also be used as a filling. The materials used to harden and make the pulp suitable are printers' roller composition, petroleum, pale resin, tanners' grease, fish glue or ozokerite. The composition is run into the tube and allowed to harden solid; the tube is heated and bent, and the composition is finally burned out.

A simple bending contrivance is shown in Fig. 2. It is only a flat piece of steel C, put on a bench with bolts to turn the tube around. The tube is cut to a suitable length and one end inserted between the jaws A and B of the tool, and a loop formed by winding the tube around it. It is then slipped off the tool and the loop straightened.

Sewing Up Thicknesses of Textile Fabrics.

In those types of rubber or rubber and textile-fabric stuffs for use in electrical service, it may be discovered that the jointing is loose. This loosening of the layers at the joint is caused partly by the mechanical disintegration caused by use and wear, and partly by the cement changing its nature or becoming affected by the atmosphere. The result of this separation of the layers of the foundation is, of course, detrimental, and should be remedied during cleaning time. You may not have cement at hand; it is possible to do a good job on an outer-tube joint nevertheless. Instead of cementing the different layers, stitch them together, thus obtaining a positive attachment common to all of the layers and preventing separation or relative movement of the thicknesses. Such a stitched foundation is shown in longitudinal section in Fig. 3. In the drawing are shown four layers, but there may be more or less. The layers A A A A are to be sewed together by the stitches B, inserted in the usual manner, into the foundation. The rows of stitching are to be spaced at a suitable distance apart, and the stitching done in successive multiple rows. Use a stout needle and waxed thread, punching the holes with a brad-awl.

The Electrical Repair-shop Grindstone.

The stone for sharpening tools in the repair shop should not be permitted to stand in water. A good way to overcome this is shown in Fig. 4, in which the water tank is arranged to be elevated and depressed. A cross-bearing C is put into the frame and a shaft B put through this. The top of the shaft is joined to the tank A. The tank remains down and the water is clear from the stand when not in use. When in use for grinding purposes, the workman presses the foot lever D and elevates the tank to a point where the stone contacts with the water. Another idea is the rest at E for grinding tools. These revolving stones cannot do good grinding if the stone is worn down on one side or gouged out. The best way to put such worn stones into condition for effective work is to rig up an iron bracket F, and put a cutting tool G into this. This tool can be set so as to bear on the revolving stone and cut off the high places down to a common level.

Rings for Repair Work.

The proper system of ring turning for use on dynamos includes two tools working together, one on the inside, the other on the outside of the flange.

FIG. 1. POSTAL COMPANY'S KANSAS CITY PLANT.—HEADQUARTERS THIRD DISTRICT.

The hardening of rings is also of the utmost importance. Rings not hard enough, or unevenly hardened, will wear out rapidly. Rings hardened too much, that is to say, rings hardened at either too high a degree of temperature or exposed to the heat for too long a time, become changed in character, the metal becoming granulous and the surface glassy. Each ring can be tested by springing, the injured rings which are broken in the process being thrown aside. The rings can be gauged with snap gauges of slight variation, not in excess of .0025 of an inch for concentricity of flange. They should be tested for hardness, for roundness, for smoothness of finish and for general appearance.

Repairing Key Connection.

There are varied types of key connections in use, and the fittings of some of these are of such character that when they break the shoulder slips off. Defects of this kind have been satisfactorily made good by the plan presented in Figs. 5 and 6, in which a groove A is cut in the former and a set-screw B put into the latter. The groove can be cut in the axle with an emery wheel. The screw may be put into the shoulder by drilling and cutting a thread near the end.

About Patents.

Many men employed around electrical repair shops often conceive new ideas, which are more or less valuable. An invention that is merely another way of accomplishing a result already obtained has no value except for purposes of protecting the field. If some prior patent claim should cover the principle and device in broad terms, its value is purely nominal. An invention that will lower the cost of making a machine is valuable, also one that will enable it to be run with less skill; but the most valuable is that which enables a larger production. With a simple invention always test it before trying to interest others in it. If it is the intention to sell the invention to some firm, do not make the mistake of getting a patent before showing the idea. Too many inventions are made absolutely worthless by bad patents. There is as much chance for skill in properly preparing patent papers as in making the invention. If a firm cares for an invention it will prefer to have the patent papers drawn under its own supervision. An invention cannot be patented that has been in public use two years before the application. If you think you have an idea that is valuable it is always well to make dated drawings and have them witnessed. A rough pencil sketch may be made the basis of a patent.

The Modern Electrical Repair Shop.

One cannot tour a number of electrical repair shops and not remark the improvement all along the line. If you take such a trip you will first notice in the modern shop a large, roomy building, especially constructed for shops, equipped with all the modern appliances, such as electric and other flanging and riveting machines, all driven in accordance with modern power-saving ideas; radial drilling machines, capable of drilling every hole in a sheet or tube without shifting the tube after being once laid on the table; electric traveling boring mills with a horizontal sweep and vertical adjustment, and with sufficient motion in each direction to drill or tap all holes required without moving after once setting; plate planers, with the traveling heads moving at right angles to each other, so that the end and side of the plate can be planed at the same time; vertical bending rolls, and numerous smaller tools and appliances to suit special work that the shop is accustomed to do. With such shops and their repairing facilities the work becomes easier.

Public Illumination Causes Excitement.

[From the Chicago Tribune.]

The lighting of the suburban municipality of Western Springs last evening for the first time by electricity was attended by considerable excitement and much agitation on the part of the volunteer fire department of the village and all the farmers within a radius of 10 miles.

Western Springs is about 30 miles west of Chicago on the Burlington railroad. Last night was the time set when its new electric-light plant was to be put into operation. Many of the citizens of the

FIG. 2. POSTAL COMPANY'S KANSAS CITY PLANT.—RECEIVING AND DELIVERY DEPARTMENT.

town and the farmers living in that vicinity had not been properly notified of the auspicious event, and for some time considerable apprehension existed as to the cause of the brilliant illumination. Citizens returning home on evening trains from Chicago were horrified when still several miles from their homes to see a bright glare over the town. They concluded the place was on fire, and from the brightness of the light figured that each house probably had been soaked in kerosene oil before being fired. The farmers around the suburbs saw the bright light in the sky, and, harnessing their fleetest horses, started to the rescue.

On one of the trains from the city which arrived in the suburb soon after the lights were turned on were a number of citizens who are members of the volunteer fire department of Western Springs. When the train stopped they led other citizens to the fire-engine house. The engine and hose cart were dragged out and pulled over the roads to the Vive camera factory, where from every window a bright light was shining. The clanging of the fire gongs startled everybody in the village, and even those who knew about the new electric lights forgot it in the excitement of the moment. But when the factory was reached it was found there was no fire, only the reflections in the windows.

The farmers on their plow horses arrived breathless on the scene and joined in the hunt for the fire. Then it was discovered that the new electric lights were responsible and that everybody had responded to a "still" alarm. The fire department went home and the excitement was over.

BOOK TABLE.

Alternating Current Wiring and Distribution. By William Le Roy Emmet. New York: 1898. The Electrical Engineer. Second Edition, revised and extended. Price, $1.

Mr. Emmet's work is well known, and in this edition the author, while retaining all his useful explanations and methods for determining the proper methods of distribution, has added a large amount of useful information and hints bearing directly upon the question of proper wiring where an alternating motor load is included in the system, which will prove of especial value. An appendix on general wiring formulæ with a table of wiring for 30, 65 and 125 cycles, and for single-phase, two-phase and three-phase work is added.

Postal Company's Kansas City Plant.

The Postal Telegraph-cable company has established modern offices at Kansas City, and has introduced many improvements in the service at that point and throughout the district of which it is the center. In the organization of the Postal company's system Kansas City is an important point, being the distributing center for the third district of the western division and including all the offices in western Missouri, Kansas, southern Nebraska, Colorado, New Mexico, Arizona, western Texas and a portion of California. Kansas City is one of the most important stations in the system, as all messages between Chicago and San Francisco, New York and San Francisco, Chicago and Denver—in fact, from all points in the East to every city in the West—must pass through the automatic repeaters in this plant.

FIG. 3. POSTAL COMPANY'S KANSAS CITY PLANT.—VIEW OF OPERATING ROOM.

The new home of the Postal company in Kansas City is a model of convenience. It is centrally located in a modern structure particularly adapted for its needs and is fitted throughout with modern apparatus especially constructed for it. The furniture and fittings are also new, and everything about the establishment is in keeping with the surroundings. The new building is located at Eighth and Delaware streets, and an exterior view is presented in Fig. 1. It is a modern five-story structure, of brick, with interior finishings of white oak, and is one of the most attractive office buildings, from point of location and general accommodations, in the city.

On the ground floor is the office of Manager Richards, together with the receiving and delivery departments. There are no instruments in the office where the business with the public is transacted, but there is a spacious rotunda, desks and chairs for patrons, and every accommodation that experience has shown is appreciated by the public. An excellent view of this department is presented in Fig. 2.

The fifth floor is occupied by the district offices and the operating room. It is in the equipment and operation that the most notable innovations have been made. Two views of the plant are presented herewith, Fig. 3 being a general view of the operating room and Fig. 4 containing a glimpse of the motor-dynamo equipment, switchboard and repeaters. It will be noticed that old-style glass partitions on the operating tables have disappeared, that the "sounders" are no longer on the table tops, but inclosed in resonators, which convey the sound directly to the operator's ears and eliminate the possibility of error by conflicting sounds. Following the policy introduced by the Postal company several years ago, typewriters alone are used in receiving messages, the use of pen, ink and pencil being strictly prohibited for such service. The new operating room is arranged to accommodate 120 operators.

The power equipment comprises the standard motor-dynamo sets adopted by the Postal company as a result of its experience. The present plant replaces 12,000 battery cells formerly used in the Kansas City office. The switchboard has the usual instruments required for this service. It is of modern construction and was especially designed for this station. Wires enter the building underground and are conveyed to the fifth floor through a hollow shaft, each cable containing 50 wires, all of which are led directly to the switchboard, where they can be connected with any instrument in the room. The automatic repeaters, which are shown on the table in Fig. 4, are utilized on the direct lines between San Francisco and Chicago and New York. These circuits are occupied entirely with "overland" business. The Postal company is particularly proud of its lines and wires, which are as essential as finely equipped offices. Many changes have been made from the early days, resulting in a gradual development of the present system. An example of present-day construction is furnished in the Postal company's line passing through Kansas City between the Atlantic and Pacific coasts, and consisting of four hard-drawn copper wires, 98 per cent. pure, and each wire weighing 300 pounds a mile.

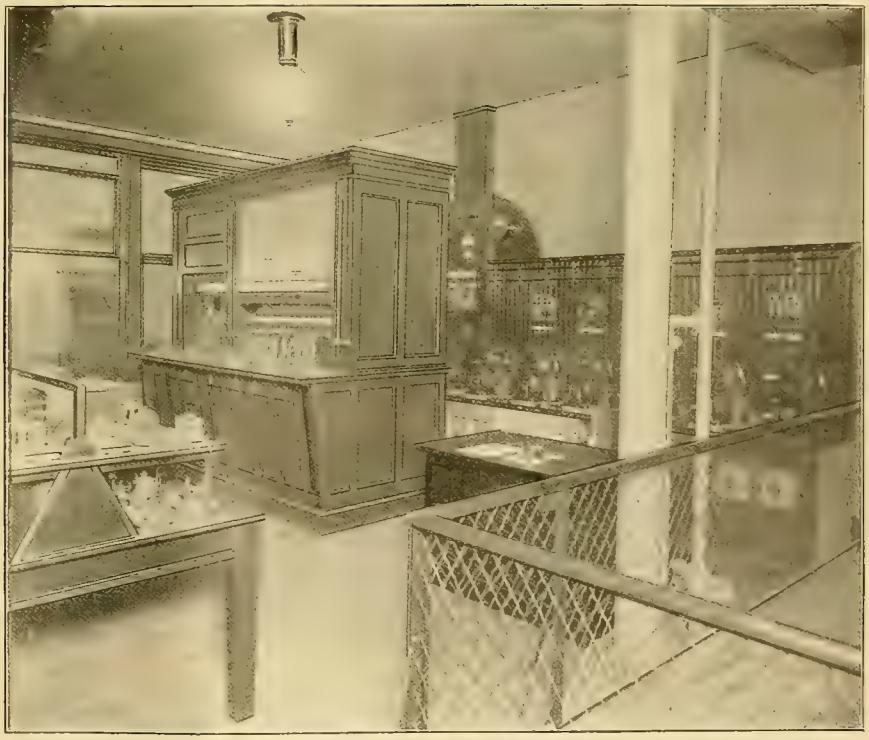


FIG. 4. POSTAL COMPANY'S KANSAS CITY PLANT.—MOTOR-DYNAMOS, SWITCHBOARD AND REPEATERS.

These wires are used solely as "multiplex" circuits to carry the "overland" business.

The details of construction and equipment of this plant were worked out by George E. Paine, district superintendent, Manager Richards of the Kansas City office, B. F. Rommell, chief operator, F. W. Jones, chief electrical engineer of the company, of New York, and J. F. Butterfield, electrical engineer, at Chicago.

The Citizens' Telephone Exchange expects to begin work on its system in Peoria this month. The engineers are now at work on the plans.

Economies in Small Electric Light Plants.[1]

By E. P. Roberts.

In the manufacture and sale of electric energy, the same principles control as in the manufacture and sale of other products. Business enterprises conducted on a large scale are generally systematized, and every item of expenditure carefully scrutinized, and the market studied. Smaller enterprises very often pay comparatively little attention to the future or to the past, merely living from day to day, and without any definite policy, and generally without the knowledge on which to base a policy.

No one will claim that any plant, either large or small, is perfectly conducted; some of the larger ones may closely approximate perfection, and some of the smaller ones may follow them quite closely. As a rule, however, the smaller plants give less attention to positive economy, or the economy the net result of which is a saving, and comparatively more attention to negative economies, or a present saving, which actually results, either immediately, or in time, in a net loss. If all the expenses of a plant are taken into account, the one will be most economical which is so designed that it can be operated to produce the greatest possible net income, taking into account, not only operating expenses, but all fixed charges, including interest, depreciation, insurance, etc.

To those assembled here, the question is not how to design the plant, but how to operate most economically that which is now in existence, and I will spend most of the time allotted to me in discussing this phase of the question. Incidentally, and if you will allow me to speak of myself, I would state that, although my present business is that of a designer of electric-light, railway and heating plants, I have had a number of years' experience in management and operation, and therefore I believe that I am competent to discuss the matter from the standpoint of the manager.

The title of this paper seems to me to be the statement of a fact, and not to need discussion. Sometimes it is very evident that a certain saving can be effected by a certain means; in many cases, however, matters seem to the person having the case in hand to promise a saving, and the results are disappointing, provided the results are known. The last statement leads up to one of the negative economies most often practiced in small plants; that is, neglect to ascertain the cost of each step in the process of manufacturing electric energy, distributing it and obtaining payment for it. It is generally considered quite sufficient to keep an account of expenditures and receipts, and to ascertain the amount of the balance at the end of certain periods, and if there is a balance, it is sufficient cause for jubilation.

Upon examination of a great many plants, I feel sure that many of them, probably the majority, could reduce their operating expenses from 10 per cent. to 20 per cent. if, first, they were better informed as to the conditions under which they were operating, and, second, they knew how to improve the conditions. It should also be noted that, at the same time that reduction of expenses would be obtained, a better service would be given, with attendant bet-

1. Ohio Electrical association.

ter feeling on the part of the consumer, both public and private.

I believe this to be a fact, and, nevertheless, it may seem as though I had an undue amount of assurance to make this statement to you gentlemen, who are, I do not doubt, in many cases wondering how you can make both ends meet, pay any dividends, and, possibly, stave off agitation for a municipal plant. I have examined a very considerable number of plants operated in cities or towns where municipal ownership has been considered, or where questions have arisen between the municipality and the private corporation, and in many cases I believe that such agitation would not have been encountered if the plant had given good service, or if the citizens had had faith in the management, and the community really believed that the service was good, and at a reasonable rate, and that the company was not making large profits.

I will give a few examples from my experience in investigating for municipalities the lights furnshed by private corporations. In each case I arrived without the knowledge of the members of the local company, and met the lighting committee, and informed it exactly what I desired. After obtaining such preliminary data as wished for, I have been introduced to the manager of the lighting company, and started taking such measurements in the station as were necessary, and then examined the lamps on the circuit. In some cases I have found that the company was furnishing a good commercial article, and living up to the spirit of the contract.

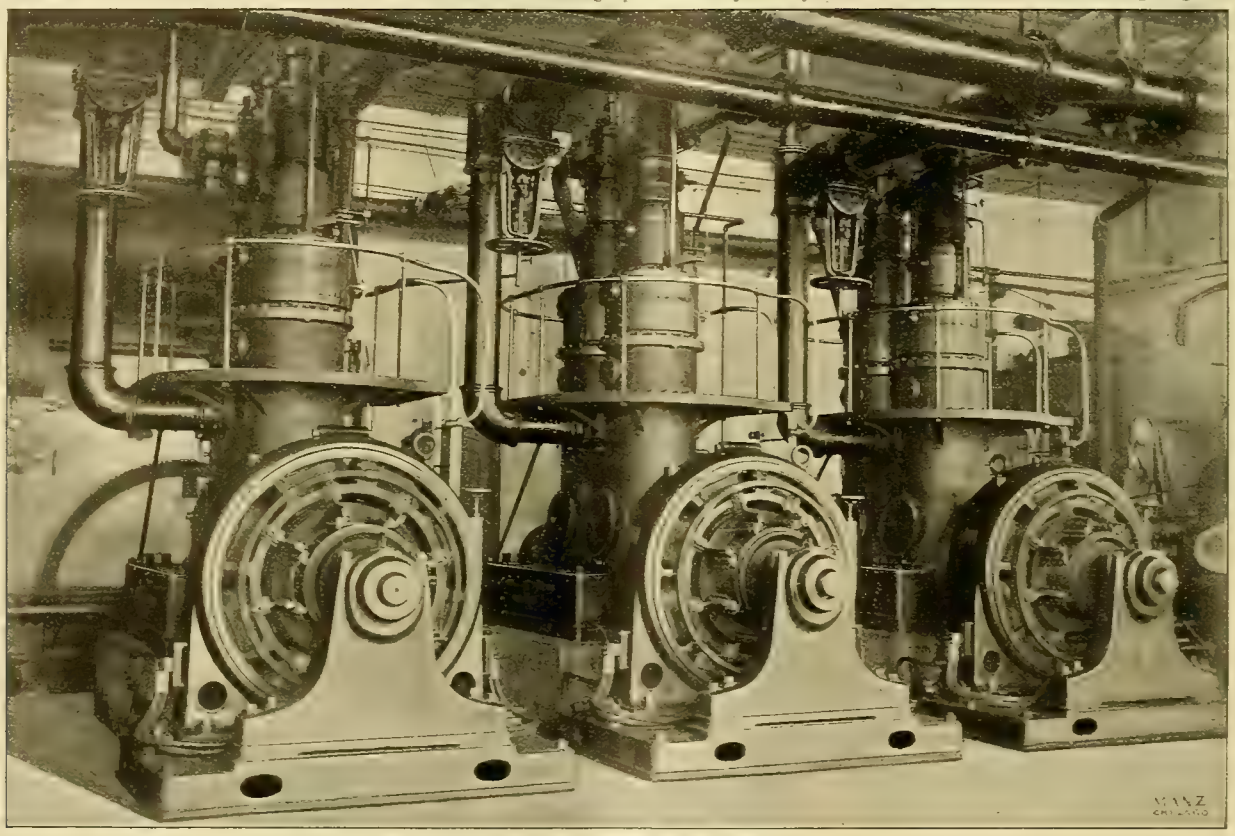


FIG. 1. WILLANS CENTRAL VALVE ENGINE.

In other cases the contrary fact was noted. Sometimes considerable indignation has been expressed at prelminary information obtained by me without having notified the company that I was in town, and the greatest objection was made by the president of the company giving the poorest service. Where the company was living up to its contract, the result of the investigation has been a much better feeling toward the company, the lighting committee of the council having a better knowledge of what it is reasonable and right to expect, and the agitators against the local company being, to a considerable extent, silenced. Undoubtedly quite often such agitators are moved by improper reasons, but it is not by any means always the case. They may honestly believe that the city is not receiving good service, and that the prices are exorbitant, and when the contrary is proved to them, they are perfectly satisfied. It is not at all exceptional to find that the current and voltage are not up to the standard, and the lamps are not maintained in good condition.

Returning to the consideration of the operation of an existing plant, we find that there is a certain capitalization and certain charges must be met. The reduction of such charges is purely a matter of financiering, and will not be considered in this paper.

If we take up the consideration of the plant from the standpoint of a general superintendent, and desire to investigate its condition, we must first ascertain the useful results and the losses in each step and then we can discuss changes either in the plant or in the handling of it, what such changes would cost, the advantages resulting therefrom, and whether any or all shall be taken up.

We may start as follows:

First—The production of power at the dynamo pulley.

Second—The conversion of mechanical into electrical energy.

Third—The delivery of electrical energy to the various points where it is to be converted into light, heat or power.

Fourth—Its conversion as stated.

Taking the points in order, we have first to consider the production of the driving power. In this case we will work backwards, that is, from the dynamo to the coal-pile. If the plant is not direct-connected, we will have belts and probably shafts. Are the belts tighter than advisable? If so, it may be because they are oily and dirty; this means increased depreciation, as well as increased power. Evidently they should be cleaned. Possibly the belt centers are too close together, and this distance cannot be increased. Possibly larger pulleys can be placed preferably (if not making belt speed excessive) larger in diameter, but if this is not feasible, wider in face. Will this pay? Suppose a belt transmitting 100 horse power costs $100, and is running too tight and adds three per cent. (three horse power) to the friction more than it would do if running loose. Suppose to change to larger pulleys costs $75 and the extra belt costs $25 additional, making a total of $100. Probably the life of the belt will be increased 50 per cent., say nine years as against six. We then have for 12 hours' run for 365 days and three horse power, a total of 13,140 horse power hours. If the additional coal is four pounds per horse power, and coal costs $1.50, we will have a saving of $39.42 annually, and a lessened depreciation of $5.55, or a total of $44.97. Not only a saving of 45 per cent. on the investment, but also less probability of breakage of belt, of poor lights because of slip, of hot boxes and consequent cost of renewals, less oil and, most important, less probability of shutdowns. This is only a small item, but how many managers would spend $100 to save a belt slipping? The station superintendent must get along with resin.

Possibly the only remedy applicable is a tightener, not a very desirable method, but generally 99 per cent. more objectionable, wasteful and noisy than necessary, because installed in the cheapest way possible. In such a paper as this we cannot consider appliances in detail, so we will pass on to the shaft. Here we find very little friction if the shaft is sufficiently stiff and in line, but if not, the friction may be from 15 per cent. to 20 per cent. of the rated load, and in many cases it is probably 10 per cent. more than necessary; therefore, for every horse power it transmits, it unnecessarily wastes in friction (if at the same rate as in the previous example) $13.16 annually in fuel, a considerable amount in oil, and increases the liability of hot boxes. The remedy may be a new and larger shaft, or new and better boxes, or the present shaft may only need alignment. The trouble and its amount must first be ascertained, and then the remedy applied. Suppose that the shaft transmits 200 horse power and loses only five per cent. more in friction than it should, how much can we afford to spend to save that five per cent.? The direct saving would be $131.30 annually, which would be 10 per cent. on $1,313, and this is the amount we could not afford not to spend, and without considering the incidental advantages.

A bicyclist knows the advantage of a light-running, well-lubricated wheel, but often he will vote against spending money to save power in an engine. It is sometimes said that a woman's idea of a horse power is only limited by the number of people who can get into the vehicle. There have been men who held similar ideas as to the horse power of an engine—"as long as the horse can do it, all right"—the same as to the engine.

We now come to the engine. In large stations it is customary to so operate that whenever an engine is in use, it is at or near its rated load or point of maximum economy of operation. Most engineers know that to run an engine on a light load is wasteful, but many do not realize that it is one of the greatest of extravagances. The losses in an engine are very nearly constant, and therefore for light loads become a very large percentage of the total. Suppose we have a 200 horse power engine in use eight hours nightly, on a load which a 75 horse power engine would run at rated load. If the engines were of the same type there would be practically no difference for these sizes in the amount of steam per indicated horse power. If we take an automatic non-condensing engine, giving one indicated horse power for 28 pounds steam, we would have per brake horse power:

For 200 horse power engine at 75 indicated horse power, 53 pounds per brake horse power.

For 75 horse power engine at 75 indicated horse power, 33 pounds per brake horse power.

Difference, 20 pounds per brake horse power.

20 (lbs.) × 67.5 (H. P.) × 8 (hrs.) × 365 (days) = 3,942,000.

If evaporation of seven pounds water per pound of coal is estimated, this gives 563,143 pounds, or 281.57 tons. This at $1.50 a ton is $422.35. In small stations, an evaporation of only five or six is often the average result, and the above amount would be proportionately increased. If we install a 75 horse power engine to take this light load after the heavy load has gone off there would be no additional depreciation or repairs, because of having the additional engine; in fact, the total might be less, because there would be more time to adjust each engine. The engine, including foundation, would cost probably $1,000 to $1,300; extra piping and building (if necessary) possibly $700; call this a total of $2,000. The only additional fixed charges would be:

Interest on $2,000 at 6 per cent	$120 00
Depreciation on $700 at 6 per cent	42 00
A total of	$162 00

(and part of this is questionable), leaving a balance of $260.35, equal to a trifle over 16 per cent. profit, additional to the six per cent. already allowed, besides obtaining a more reliable plant.

In the majority of small plants the engine, or engines, run for many hours at a very light load.

[*Continued on page 287.*]

Willans Central-valve Engine.

The accompanying cuts illustrate the Willans central-valve engine, Fig. 1 being a view of the equipment of the Nichols Chemical company's works in New York which employs this type and Fig. 2 being a sectional view of the engine. The Willans engine is of the upright type and the cylinders are arranged on the tandem principle. A remarkable economy of steam consumption is claimed for the combination, as well as great durability at high rotative speeds. The makers say that the single-acting principle adopted in this engine must in a large measure have credit for the possibility of continuous running at high speeds, more especially when assisted by an air cushion. When steam acts on one side only of the pistons, and this on the top side in an upright engine, the working strain is exerted in a downward direction, and there is no force due to steam that can lift the pins away from the bearings, as there is no reversal working strain. This means entire absence of back-lash at centers. The only force, then, capable of causing hammering in joints is the momentum of reciprocating parts, and in the Willans engine it is ingeniously counteracted by an air cushion, which, acting on the up-stroke, destroys all dangerous tendency in this direction. It is introduced without complication by converting the usual cross-head into a deep piston which, moving into a cylinder, open below, acts both as an air cushion and piston-rod guide.

Another special feature is the valve gear. Unlike the design of ordinary steam engines, the eccentric is fastened on the center of the crank pin, and it gives motion to the distributing valve, which works inside the hollow piston rod. The latter extends entirely through the line of cylinders, is open at both ends, and, by means of properly situated ports,

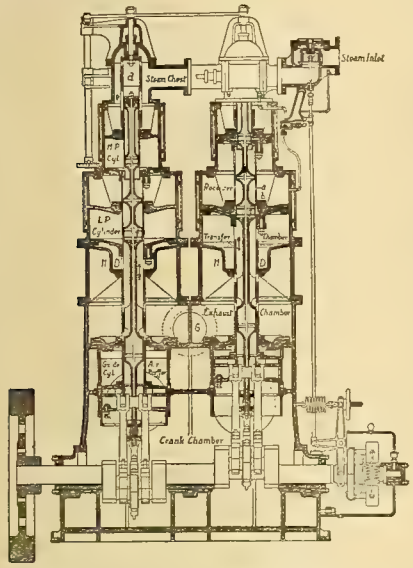


FIG 2. WILLANS CENTRAL-VALVE ENGINE.

cut into its walls, steam is admitted into an exhaust from the cylinders through this hollow piston rod. The valve, a series of pistons, mounted on a common rod, having a motion relative to the hollow piston rod, effects the admission and exhaust, but the cut-off of steam inlet is produced by the piston rod itself, when the latter passes into a packing gland whereby the admission ports are covered.

This arrangement gives the engine an extremely sharp cut-off, which is made variable either by hand or automatically by the governor. The valve is balanced and steam-tight, each individual piston being provided with packing rings.

All reciprocating parts below the low-pressure piston are enclosed in a chamber containing a certain amount of oil and water, which, violently agitated by the action of the running parts, penetrates to all surfaces in wearing contact, thus effecting a thorough lubrication; at the same time, by reason of the water present, it assures cool bearings. A striking feature of this engine is the small floor space it occupies and low shipping weight, which is of particular importance to purchasers whose transportation facilities are poor.

This engine is controlled in this country by the M. C. Bullock Manufacturing company of Chicago.

X-ray Proposed for Printing.

[From the New York Tribune.]

George Isambard, a Frenchman, has taken out a patent on a process which he thinks will revolutionize the art of printing. He proposes to use photographic paper to receive the impressions produced by his system. And he does his work by means of X-rays. A plate is prepared by tracing on paper with ink which is proof against this form of radiance whatever words or designs it is desirable to reproduce. Such a screen having been set up in front of a sheet of sensitized paper, the current is turned on in his X-ray tube. Where the screen has not been protected by ink the rays go through and make an impression on the sensitive paper, turning it dark. But where the ink shuts them off the paper remains white. Thus the copy obtained shows the writing and pictures in white on a dark ground.

M. Isambard would arrange his printing paper in packages several layers deep, so that a number of impressions can be obtained simultaneously. Indeed, he thinks that a number of packages might be adjusted around the tube, inasmuch as the rays proceed in all directions from the place where they originate.

This idea is ingenious, but no publisher is likely to sell his presses immediately in consequence of M. Isambard's invention. The scheme has many drawbacks. It costs a good deal to sensitize paper, and the price of books and newspapers produced by this method would be greater than now. The intensity of the X-rays diminishes with distance, and the rear layers of paper in a package would not be so strongly impressed as the front ones. It would be hard to regulate the time of exposure so as to get good results in both places. The process would require more time than is spent in printing by the old method. There are newspaper presses that turn out 25,000 or 50,000 copies an hour. It would take a week or a month by M. Isambard's method to get that number of impressions.

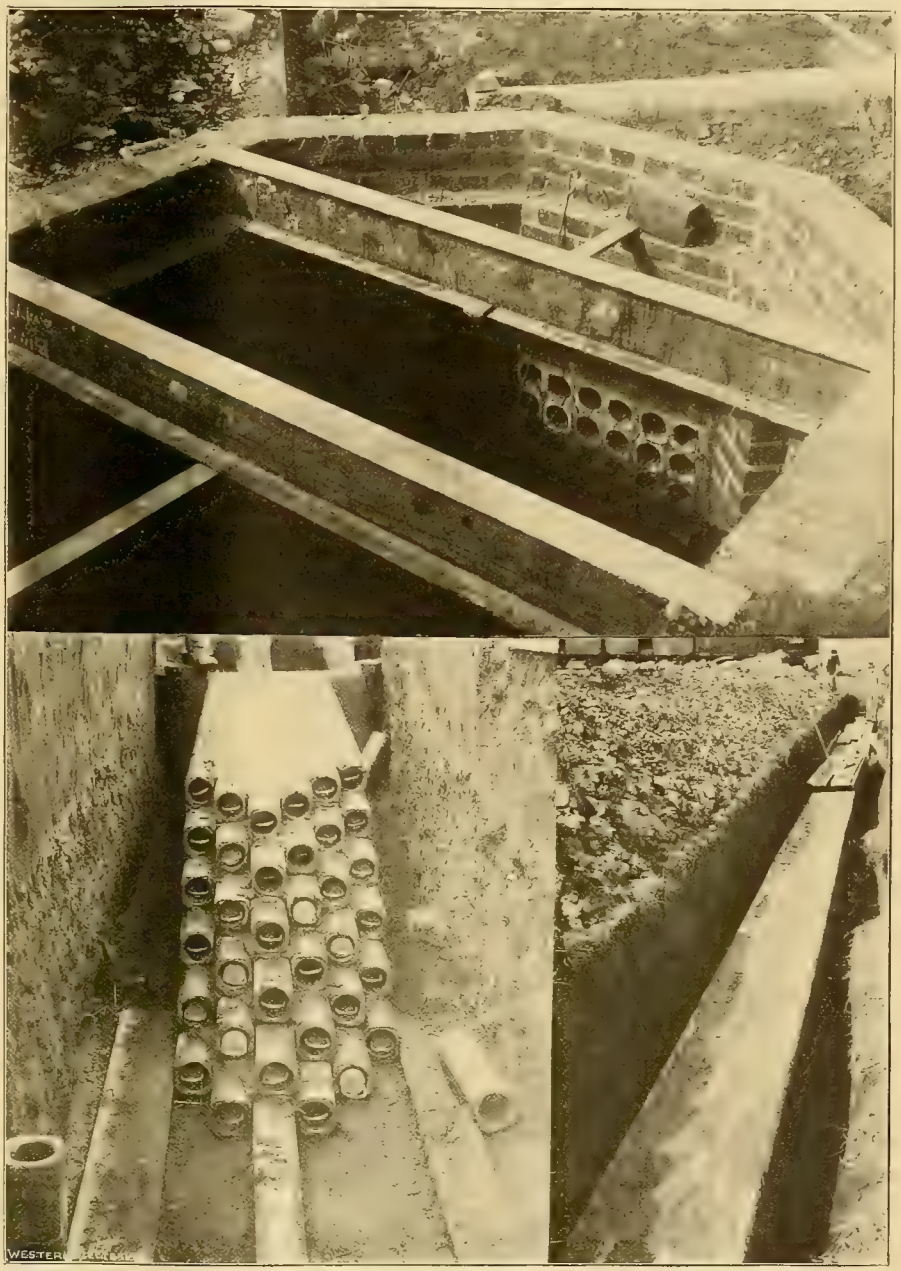
Moreover, the best X-ray pictures are blurred around the edges. This would be the case with any printing done by the new process. But with type there is already only too much indistinctness, owing to fast work and poor ink and paper. The public will not buy papers and books that are more illegible than those it now reads, especially if it must pay more for them. M. Isambard is not likely to reap a fortune out of this idea.

The last directory issued by the Danville (Ill.) Telephone company contains the names of 450 subscribers and a list of 200 toll connections.

Cable Conduit at Niagara Falls.

In order to distribute power to the Pittsburg Reduction company and factories lying between that plant and the power house, the Niagara Falls Power company built a cable conduit from the power house eastward on its lands. This conduit was in the form of a horseshoe and was made of concrete. Brackets on the sides support the cables.

The power company has until now run cables to the manufacturing plants east of the aluminum works, over ground protected by a box covering. In order that the cables might be more substantially laid, the power company is now building a new cable conduit, running eastward from the end of the first conduit to the site of the Union Carbide company's plant. The length of this new section of conduit is 1,230 linear feet, and it is built of vitrified tile made by the H. B. Camp company. The trench is excavated to a depth of about five feet, and in it are laid 36 ducts, each 3½ inches. The nest of tiles occupies a space of two feet five inches. They are bedded in cement, that on the top and bottom being four inches thick, and on the sides two inches. All joints are half broken, and the mandrels used were pulled about every third tile.



Building New Conduit. Construction of Manhole. Box Covering for Cables.

CABLE CONDUIT AT NIAGARA FALLS.

Along the line of the new conduit there are several manholes, eight feet deep. They are octagonal in form and built of brick. Piers are located on the sides to hold brackets to support the cables. Across the top of each manhole are two iron girders to support the proposed arch covering. Through all the ducts, from manhole to manhole, No. 8 wire was run to facilitate laying the cables. The contractor was R. D. Young of Niagara Falls.

In the accompanying illustration the several features of construction alluded to are shown. One view shows the box covering for the cables, heretofore used, another the new conduit of tiles, and the third, occupying the upper portion of the cut, a typical manhole in the new system.

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An innovation has been made by the Chicago City Railway company in fitting up a train of two vestibuled cars to be operated on a trolley line, the motor car being reserved for smokers. There are several important features about the equipment, but the most important is the fact that protection will be furnished the motorman during the severe weather. The North Side cable trains are being arranged so that the gripman will be protected, and all the electric cars on the Yerkes system are to be vestibuled. The change is certainly creditable to the companies.

The old question of the responsibility of telegraph companies when the "conditions" printed upon the back of blanks furnished by the company are not complied with by the sender of a message has been raised again, with the result that one more decision has been added to the list declaring invalid the terms alluded to. In the case mentioned a Chicago wholesale house telegraphed an attorney to attach property of a merchant to the amount of a claim for $790. The message was forwarded with the figures spelled out as usual, but the omission of the letter "s" from the word "seven" made it read "even hundred ninety dollars." The attorney attached property to the extent of "even hundred ninety dollars." Other creditors of the merchant also attached property, and when the error in the message was discovered it was too late to correct it. The Supreme Court of Nebraska held the telegraph company liable for the loss of the sender of the message and affirmed judgment for $600. In the decision the court holds that "A telegraph company is liable for all damages sustained by reason of its failure to correctly transmit and deliver a message received by it, notwithstanding an agreement printed on its blanks to the contrary."

An organization of women in New York is engaged in advocating reforms for the benefit of the public. The society is known as the Woman's Health Protective association. At present it is engaged in bringing influence to bear upon street-railway companies to secure the correction of abuses in the management and improvements in details of the service. At the last meeting there was a great deal of talk about co-operating with President Guggenheimer of the New York Common Council in his efforts to have the steps of trolley cars lowered, and the women determined to use every effort possible to accomplish this. They also decided to see if the straps in cars could not be arranged so that short people could reach them without straining themselves. The members propose to see if they cannot stop the overcrowding of the open cars before another summer is here.

But the main work in hand at the moment is the effort to put a stop to expectoration in the cars. The chairman of the meeting said: "We have made great improvements in this direction, but now that winter is here it behooves us to be up and doing, for we all know to our discomfort how men will expectorate all over the cars at this season. With the assistance of the Board of Health we have succeeded in getting conspicuous notices, prohibiting this vile habit, posted in all cars on every line in the city, but we cannot afford to stop there. Every conductor must be impressed and instructed that it is a part of his duty to speak to every human being who violates this ordinance." The organization deserves encouragement, particularly in its crusade for cleanliness. It should receive the active support of every decent man, and branches should be established in every city of the country for the suppression of offenders. Street-railway companies will co-operate with them in this particular at least.

Among the patents issued last week was one granted to Nikola Tesla upon a "Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles." The latest production of this prolific inventor has attracted almost as much attention as any that preceded it, not because of any value it may possess in the commercial world, nor because of any promise it may offer to revolutionize industrial methods, but simply on account of its sensational or spectacular character. It may be described as a proposition to conduct naval operations on a large scale by means of electrically operated mechanism controlled and supplied with power from a distance, after the manner of wireless telegraphy, without endangering the life or safety of those employing the Tesla apparatus. It is an attractive scheme from this view, and has afforded much entertainment for newspaper readers who can enjoy visions of wholesale slaughter provided the enemy alone suffers. As compared with the present methods of conducting war Mr. Tesla's plan is on a gigantic scale that cannot fail to win commendation from those who believe in the concentration of forces and employment of machinery instead of individual effort. Probably it would be just as well if war should be conducted in this manner, if at all, for then there might be some prospect of a general revulsion of sentiment. It has long been contended that the reign of peace would only be ushered in when war became so terrible as to deter civilized nations from engaging in it. Tesla's plan, if worked out successfully, would certainly be a long step in that direction; but then this is anticipating beyond reasonable bounds. It is not claimed that Mr. Tesla's invention is intended to be used in everyday maritime service, and it is not anticipated that commercial advantage will be reaped from his experiments and researches in this line. Probably the most important result is the fact that it has furnished some relaxation and recreation, and that the wonder everywhere expressed may afford some compensation for the toil which the development of the plans required.

An excellent idea of the condition of the electrical industry can be gained from the copper market, as the demand due to large construction enterprises always influences prevailing prices. It has been noticed for some time that there has been a gradual improvement in tone, and the people of the copper district in Michigan have been feeling good over the improvement in their trade. It was reported last month that, owing to the activity of the copper market, the telegraphic business at Houghton had increased so as to place the Western Union office of that town third in the list of Michigan cities. Detroit and Grand Rapids alone transact more telegraph business than Houghton. The great bulk of the copper town's telegraphic business relates to mining transactions. Other indications are not wanting to corroborate this view of the condition of the market. Last week lake copper was 13 cents a pound in the metal market, the highest price in a long time, and an advance of one cent within a month. The advance has been due not only to an increased general demand, but especially to heavy orders for the metal from Europe for electrical street-railway purposes. There has been an enormous increase, copper men say, in the building of electrical railways in Germany, France and England. There has been a corresponding improvement in the electrical construction in this country, and this has naturally stimulated trade considerably.

It is probable that Congress will be called upon during the next session to make provision for the organization and maintenance of a comprehensive electrical system in connection with the plans for coast defense, which are sure to be urged as a result of the war with Spain. The annual report of the chief of ordnance of the War Department has been submitted to the secretary of war, and, unlike most of the reports of bureau chiefs in the department, the history of the Ordnance Bureau for the last year is not largely taken up with matters directly connected with the Spanish war. Some interesting observations are made by General Flagler, however, on the efforts that have already been made to secure the necessary funds for carrying on the work under consideration.

Attention is especially invited to the experience of the last few months in attempting to provide quickly a coast defense. It is believed to be impracticable, and we will always be forced in any emergency to rely upon what has been provided in time of peace. I think it fair to state, though not in the way of complaint, that this has been urged upon Congress each year for the last 10 years. The situation is very simple. A plan has been adopted for providing a complete coast defense. With the present facilities of the department this work can be carried on economically and in the most efficient manner in such a way as to complete the present plan in about seven years. Estimates ought to be submitted each year for so much of the work as the facilities for its production will permit. It rests with Congress to determine how much of the work can be provided for each year consistently with the resources of the country. But the work cannot progress faster than the appropriations provide for.

This applies with equal force to the electrical features of the system. It is unnecessary to recall the details of the conditions prevailing at the time of the outbreak of the war, and of the hurried preparations that were made. General Greely and his assistants enlisted the co-operation of the electrical fraternity, and no doubt the same patriotic impulses which prompted the volunteers at that time would make them offer their services again in an emergency, but it is not right for the government to depend upon such measures. With a foe better prepared for the struggle the country might have been found in an exposed condition, and, for a time, at least, the enemy might inflict great damage. It behooves Congress to make adequate provision for the organization of a much larger force of electrical engineers than that which comprised this branch of the service a year ago.

Economies in Small Electric Light Plants.

[*Continued from page 284.*]

Whether or not the addition of a small engine coupled to the same dynamos, or to an additional and smaller dynamo, would pay, can only be ascertained by special examination into all the factors in each case. In one case a change was made, by the advice of the writer, in the shafting arrangement, and the entire cost, including an addition to the building, was repaid in a comparatively short time. It is often said, even by engine men, "Do not get your engine too small." This is wrong; the proper advice is, "Do not get your engine cylinder too large—only large enough for the maximum work it may be called upon to do, and do not get the other parts too small." This refers to an engine for a variable load. The best proportions for a constant load are different, especially if the engine is compound, as to the ratio of the cylinder diameters. In some cases too low steam pressure is carried, and in others it would pay to condense. It is often a fact that the valve and piston leak, and that the valves are not properly set. Such losses may readily amount to 25 per cent. of the steam consumption, and not be accompanied by heating or pounding. How much can be afforded to save 20 per cent. of the steam? Practically 16 per cent. to 18 per cent. of the cost of the coal, being a little less than the 20 per cent., because some coal is used for banking and starting fires. A station burning two tons a day at $1.50 a ton, or $1,095 annually, can afford $175.20, and even if this entire amount be spent the engine will run better and with less depreciation.

We next come to the delivery of the steam to the engine. In many cases the steam starts wet, and at too low a pressure, and becomes still wetter and considerably reduced in pressure before it reaches the engine, does not maintain pressure to the point of valve closure, exhausts at too high a terminal pressure, has too much back pressure, and the heat energy of the exhaust is not utilized to as great an extent as feasible. What is often needed is larger pipe, with long bends, steam separators, sometimes steam reservoirs close to the engine, well covered pipe, free exhaust, efficient feed-water heater.

Next we arrive at the production of the steam. Here we require boilers sufficiently strong, with good circulation, kept clean inside, tight settings, sufficient draft for rapid combustion, grate areas properly proportioned to the output of the boiler, and to the coal to be used, feed water as hot as possible and free from oil and coal, with the greatest number of heat units per dollar of cost in the furnace.

Everyone knows that a good fireman can save 25 per cent. to 50 per cent. of the coal used by a poor one, or by the good one if he is not intelligently checked. This last remark is not always added. Possibly the heating surfaces are not kept clean inside and outside. A conservative estimate of loss is five per cent. to 15 per cent. Next, the settings are not tight, loss two per cent. to five per cent; grates too large or too small, with fires too thin and in holes or too thick for the draft and the coal, loss 10 per cent. to 20 per cent. Perhaps coal at $1.25 a ton is being used and evaporating less water per dollar than coal at $1.50. Possibly changes in the furnace would reverse the case and the $1.25 coal would be a positive instead of a negative economy. Often the feed water is at a lower temperature than necessary, possible saving up to 15 per cent. Perhaps a new boiler is needed, or a larger stack. The saving to be effected and the cost can be closely approximated.

We will next consider the electrical end. Whether alternating current or direct current be used for incandescent lighting, the great point is to deliver at constant pressure. If the consumer furnishes his lamp renewals, it may not seem to be of great importance, but from the standpoint of giving satisfaction, it is second only to reliability. The voltage at the lamps in most town plants, and in many city plants, has, I believe, a fluctuation of over 10 per cent. and in some cases of 15 per cent. A range of not over six per cent. is exceptional. In very few plants is the fluctuation known, and in nearly every case where ascertained by the writer it has been a great surprise, and hardly credited by the client. Most stations have a lamp breakage of 20 per cent. to 40 per cent. in excess of the amount readily obtainable. In order to improve in this particular, a study of the conditions of operation and record of voltage at a number of places is necessary, and often a great improvement can be made at a slight expense. In one case—a plant of about 3,000 lights—we found part of the town operating at a very high voltage "because they had to for another part of the town," 110-volt lamps were in use, 125 volts being noted in some cases, 100 in others. It cost about $150 to add a little wire and to take down wire in one place and put in another and bring the whole network so that it would rise and fall together. This was a direct-current plant. In an alternating-current plant of about the same size, the difference of voltage between the different parts of the circuit, and the hourly variation, was still greater. In some places the lamps would not last and no one was satisfied. It cost $100 to plan changes costing another hundred, and to save several dollars a day, and, still more important, satisfaction was given. In both these cases the voltage at the station was maintained practically constant, without reference to the load, and this is a common error. Changes to produce good results cannot always be made so cheaply as in these cases, but generally the distribution can be improved and placed under control without an excessive expenditure.

If alternating current is used, it is important to have as large transformers and as few of them as practicable, often feeding into a network, at least in the business portion. This has been much discussed recently, and especially in the paper by W. F. White, read at the Omaha meeting of the American Institute of Electrical Engineers.

Under the head of "The Devices for Transforming Electric Energy into Light or Power," the savings to be effected—are largely dependent upon the distribution. High-efficiency incandescent lamps, that is, those requiring the minimum watts per candle power, cannot be used if the voltage varies. The maximum difference of potential in the arc cannot be maintained, nor can satisfactory light be given, by constant-potential arc lamps on varying voltage. Motors will not govern well if the voltage drops, and would take an excessive current if forced to do the same work as at a higher voltage. For constant-current arc lamps, the rated current must be maintained. Keeping the mechanism clean, not wasting carbons, and similar details of operation, are points to watch.

As stated at the start, in order to put economies into operation, we must know where we can save; and this necessitates the knowledge of what is being wasted, how much it will cost to make the saving, and whether the balance will justify the expenditure. Sometimes it may be realized that a saving will result from a given outlay, but the money is not available. If it actually cannot be obtained, there is nothing to say, but in most cases it can, if those having to furnish it are fully satisfied that their present holdings will be greatly enhanced in value thereby. To ascertain the true condition of any plant, it is necessary that it should be carefully tested by someone having a broad knowledge of such matters. He should have, not only a training as an engineer, but also as a station man, being able to discriminate between efficiencies under special conditions (important as it is to know them) and the efficiencies which can be expected in the regular run, and how far it is practicable to improve them.

Often very considerable improvement can be made at a trifling cost, but to obtain the maximum value a system of keeping accounts of cost must be followed, and it is not necessary that the system should be very expensive. It does not cost much to ascertain the water evaporated per pound of coal, but if the manager and fireman both have this information, and also know what should be obtained, it may make a saving of 20 per cent. to 25 per cent., and with a good fireman may save 10 per cent. of the fuel. Would it not pay to ascertain the facts, and to keep a record?

This seems to be going back to the boiler and commencing over again, but it is not; it is meant to illustrate the advisability of keeping records. A wholesale tailor is informed as to how many suits can be made from a bolt of cloth, and how many are made. The producer of steam considers measurement with the engineer's yardstick "theory." This unit of measure is as much a fact as is a yardstick, but whatever it is, if it saves 10 per cent. to 20 per cent. it is a pretty good thing to have around.

In the same way it does not cost much compared with the saving effected to ascertain what is being done in each step in the manufacture and distribution of electric energy, and to record it. The value of such a record, if it is understood, will shortly become inestimable. Each plant is a special study as far as the question of improving it is concerned, but all have the same steps to go through, and a comparison of results is helpful. Care must be taken, however, as such data may lead to erroneous deductions, because of a lack of knowledge of all the conditions or not having a special knowledge on which to base a decision.

Economy in the payroll is a negative economy too often practiced. Generally all men employed about an electric-light plant work hard, for long and often irregular hours every day or night in the week, and use up enough energy to make the money received not an over-payment. What is needed is to have the energy directed so as to produce the best results. Any good man takes pride in the result of his labor, mental or physical, and if in charge of machinery he treats it as something almost human. If he is allowed to keep it up and proper facilities are furnished, and the results of his efforts are known to the management, the depreciation and repair charges are a minimum. Put machinery in a dirty hole, exercise parsimony in buying oil, waste, brushes, soap and rags, and now and then paint or whitewash, and what can be expected? Of course there is a limit in the opposite direction, but it does not call very loudly to be considered.

In conclusion, ascertain the facts as to the present condition of operation, make such improvements as possible by better adjustment or handling.

Make such additions as will bring 15 per cent. or more on the investment, at the same time adding to the reliability and lessening the depreciation, and as fast as the necessary money can be obtained, pay for them.

Keep records and study them.

Obtain and maintain a desire on the part of the employes to better the record.

DISCUSSION.

M. E. Turner of Cleveland: I would like to ask Mr. Roberts if he finds many plants in which the variation in pressure is over 10 per cent. It seems to me three per cent. is a very great variation; when you get to 10 or 15 per cent., it seems enormous.

Mr. Roberts: For some time I was superintendent and manager of the Swan lamp company; and a man who goes into the lamp-manufacturing business learns a great deal about variations. I will say that 30 per cent. is unusual, but 15 per cent. is very common. As good as three per cent. above or three per cent. below, not only in different parts of the town, but in different hours of the 24 at the same place, is unusual.

Mr. Holmes: I would like to ask Mr. Roberts if questions of economy don't arise in large installations that cannot be exercised in smaller plants?

Mr. Roberts: I think that is true; and still, I think that those operating small plants very often take that as a fact, and don't economize or care to save. I think that too many are satisfied to ignore the small savings. If economies were practiced in small plants the gross savings might not be so large, yet the percentage of saving might be as large as that upon the same items in a larger plant, and it would not cost as much to ascertain the items of saving in a small plant as in a larger one. Of course, a large station has an advantage in a great many respects.

Mr. Foster: I see that you referred to taking measurements in the station. Now, isn't the proper place usually at the lamp terminals? And do you find that, taking the regular measurements out on the lines, the readings vary in distance from the stations? Where do you usually start?

Mr. Roberts: First in the station; afterward on the lamps. If we are on constant current we can't cut the circuit out on the line to get an ammeter in there; so the usual way is to put the ammeter in the station, and then go out and take the tension on the lamp. I am quite often called on to take photometrical measurements on some of those old contracts calling for lamps of 2,000 candle power. Sometimes they insist upon photometrical measurements, and we make them; but we tell them they will be charged extra for them, and that there is no sense in them; in some other cases we tell them in advance there will be no sense in it, give them our figures, and they don't take the photometric measurements. We ask what is the regularity of flow of current, the regularity of feed in the lamp, the commercial quality of what is supplied; also whether the lamps are well attended, kept pretty clean and under commercial conditions. Of course, if it is a constant current we have to go at it practically, put an ammeter in the station, and leave a man there to watch it; we put our ammeter in and check all the others. In one case I found quite a little discrepancy. There were three ammeters on the arc circuit; one was quite a little off, and the station superintendent didn't know it. He intended all right; but the lamps were burning rather poorly. He kept boosting up his feed, trying to get a longer arc, but, of course, the lamps were jumping. He hadn't tried one ammeter with the other to see if they read together.

W. S. Smith of Toledo: I would like to ask if there is a plant operating anywhere that the people don't believe is making large profits. I know that is the case in our city, and as a result we are going to be hampered with the question of municipal lighting. I would like to know under those conditions what can be done. We don't care to let them look over our books to prove we are not making an immense sum of money, or heavy profits.

Mr. Roberts: The matter may be adjusted by referring it to certain men who are not stockholders, but who have standing in the community, and letting them look at the books. I don't say that is the right way; but I think very often the public will not accept the statements of the superintendent or manager, or those having direct charge of a plant, when with a little more tact the conditions would be quite different.

Mr. Smith of Toledo: In our city, where we are operating a street railroad, incandescent and commercial service, it would be a hard thing to get any one to look over our books, and to form an intelligent idea upon which to base a report of what we are doing, and what we are making on our street lighting alone, unless they were experts; and the opinion of experts with the ordinary taxpayer does not carry much weight just prior to an election.

Mr. Foster: I would like to ask, in connection with that matter of measurement, can you get through the use of the photometer a proper test of the arc light?

Mr. Roberts: I don't like to measure arc lights on the street. I know where cities want them measured, they think the arc lamps are scant candle power. We take the carbon used, and a sample lamp, set up our photometer, using a 50 candle power incandescent lamp; we begin at the place selected, try to find an average and use that lamp. We establish a standard distance between the photometer and the arc lamp, so that we are not liable to a large percentage of error. Then we find that this lamp, burning at such and such an average voltage and current taken at that time, will give such a candle power; and then tell the cities that that is not worth anything, anyhow.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The service of the Iowa Telephone company at Creston, Ia., is provoking a good many complaints. The night service is execrable, and the Sunday service is limited. As the company's franchise is about to expire, and a new one will be asked for, it is probable that the objections will be considered.

The telephone company at Bloomfield, Ia., is about ready to begin operating its exchange.

The Wisconsin Telephone company announces at Oshkosh, Wis., that the rate after December 1st will be $1 per month, returning to a figure formerly made. The local Northwestern makes the same price.

Henry A. Coit of St. Louis has been granted a franchise at Nebraska City, Neb., for a telephone exchange.

The Lamoni Telephone company of Lamoni, Ia., is building a line to Davis City, where it will connect with a line from Leon by the Leon company.

From November 1st toll rates from Renville, Minn., to nearby points, in the county, were raised five cents, and to towns outside the county were reduced from 40 cents to 25 cents.

The Inland Telephone and Telegraph company has completed a line from Spokane, Wash., to Rossland, B. C., and Northport, Wash.

Liberty Center, Ia., now has toll-line connection.

The Home Telephone company's wires at Oskaloosa, Ia., went down in a recent storm, but were speedily replaced.

The Home Telephone company of Sioux City, Ia., has let the contract to Pierce, Waterbury & McAllister of Mason City, Ia., to build a copper metallic circuit from Sioux City to Des Moines. It is to be completed by September 1, 1899.

The Henry County Telephone company has been incorporated at New London, Ia., to build a line to Lowell. Work will be begun at once.

The Iowa Telephone company is progressing rather slowly in rebuilding its Sioux City plant, and will probably be unable to complete it before January 1st.

A new switchboard has been put in the telephone office at Owatonna, Minn. The exchange is growing and the old board was not large enough.

A line gang in the employ of the Wisconsin Telephone company was arrested at Platteville, Wis., for violating a village ordinance in stringing wires without signing a guarantee bond.

A telephone line is being built between Boone, Ia., and Mackey.

The Duluth Telephone company has been granted a franchise at Cloquet, Minn., for a telephone connection and has begun work on the line. The company has bought the line of Mr. O'Brien to Carlton from Cloquet.

A. White proposes to establish a telephone exchange at Rolfe, Ia., if he can secure sufficient patronage.

The Fort Dodge (Ia.) Telephone company is building a toll line to Manson.

The Michigan Bell Telephone company offered to furnish the city of Negaunee, Mich., cheaper telephone service than the local company. The latter got a hearing before the council, and that body decided by a vote of four to three to reject the proposition.

The Iowa and Nebraska Telephone company has the line from Ponca, Neb., to Martensburg, Allen and Dixon about completed.

The Midland Telephone company has completed its line between Adrian, Minn., and Ellsworth.

Mr. Cole, manager of the Iowa Telephone company's Red Oak office, has resigned to accept a position with the Missouri Telephone company at St. Joseph.

The Iowa Telephone company gave free service from 6 p. m., Tuesday, November 8th, to 7 a. m., November 9th, between chairmen of the several county committees and between the newspapers in its territory. The only provision was that the service must not interfere with commercial business. This gave the newpapers, as well as the politicians, a chance to get election returns gratis.

E. M. Walsh has ordered a new switchboard and other apparatus for the telephone office in Crookston, Minn.

The Northern Minnesota Telephone company of Park Rapids, Minn., has been incorporated, with $10,000 capital stock.

The new telephone company has made toll-line connection with Northwood, Ia., and it is understood will apply for a franchise next season and put in a local exchange.

Early in the spring the Standard Telephone and Electric company will connect its toll lines in southern Minnesota by building from Canton on the west and Caledonia on the east. The line will be a metallic circuit.

An effort will be made soon to build a telephone line between Victor, S. D., and Mount Vernon.

Dysart, Iowa, is seeking distinction. The Reporter of that thriving town announces that "as for its size we believe Dysart has more telephones in use than any town in this section of the state. We predict that fully 80 telephones will be in use in Dysart before January 1st. A good showing by a good people."

Evolution of the Telephone Signal.

By H. P. Clausen.

Undoubtedly Philip Reis was the first to employ an electric signaling device in connection with an electric telephone. It consisted merely of the Morse circuit-breaking key connected in a series circuit with the telephone sender and receiver, a galvanic battery and an electromagnet arranged with a movable armature so placed before its pole-pieces that the alternate breaking and making of the circuit would result in the production of a signal sufficiently loud to be heard. With slight modifications this form of telephone signal served its purpose admirably, and, inasmuch as the telephone often failed to operate the telegraphic circuit, by means of a prearranged code of signals, allowed the interchanging of suggestions, which probably often led to re-establishing the telephonic communication.

Many years after Professor Reis' vain attempt at producing a practical electric telephone, Professor Graham Bell discovered that the signal-receiver which in a telegraphic sense had been employed by Reis could be made to transmit and reproduce articulate speech. As a matter of fact, if Reis had, in the place of the platinum "make-and-break" arrangement, fastened the armature of his signal-receiver to the membrane of his speech transmitter, he would have produced an instrument equal, at least, if not superior, to Professor Bell's earliest form of magneto-telephone.

Referring to Fig. 1A, we have shown the simple telephone circuit; that is, the T and T' hand telephone connected together by means of the wires W and W'. It represents the complete talking circuit. However, some means of signaling had to be arranged, for whenever an operator at the T station desired to attract the attention of an operator at the T' station, and vice versa, some means had to be provided for making known the desire for communication. At Fig. 1B we have shown the

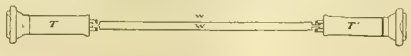

Fig. 1A.

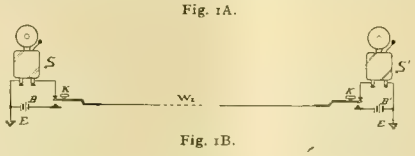

Fig. 1B.

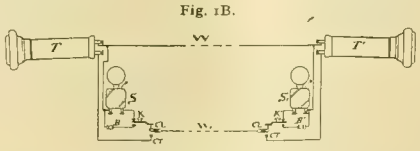

Fig. 1C.

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plest form of signaling system with an electric battery and normally closed bell circuit at each station of the circuit. Inasmuch as this arrangement required three wires and the earth as a return circuit for the signaling current, the arrangement shown by Fig. 1C was adopted. As will be observed, the wire W serves as a terminal for one side of each: the hand telephone, the calling battery and the signal-receiver. With this arrangement of circuits, when it was desired to operate the signal-receiver S', the push-button K, when depressed, would allow the current from the battery B to pass through the switch lever C L over the wire W' and through the push-button K' to the signal-receiver S' and line wire W back to the battery B. In responding to the bell signal an operator at the T' telephone would give an answering ring, and, at the same time, bring the lever C L' into contact with the point C T'. On receiving a response to his signal the operator at the telephone T would also place a lever similar in operation to the C L' into contact with the C T point. Such an arrangement of circuits permitted both a signaling and talking service with only two wires. However, there was the objection that whenever, after completing a conversation, either of the operators failed to restore the C L switch lever to a point connecting to the push-button K, the signal-receiver would not form a part of the line circuit, and its signal-receiver could not be operated from the distant station. For the purpose of avoiding this difficulty the hand telephone was connected by means of a short cord to the somewhat modified switch lever C L (Fig. 2), the circuits remaining the same.

This switch lever virtually was a light spring which normally tended to force itself up and into contact with the point S C, and thus establish a talking circuit. When released the hand telephone was of a sufficient weight to overcome the upward tendency of the spring C L, drawing it downward and into contact with the point C and thus automatically re-establishing the signaling circuit.

In order to keep pace with advances made in the transmission of speech over longer distances, the battery-signaling apparatus had to give way to a more efficient means of signaling between distant stations. As a result the hand-driven dynamo, associated with the proper signal-receiving apparatus, was adapted to the needs of a telephone-station equipment. Briefly, the signaling equipment of a telephone station soon resolved itself into a standard piece of telephone apparatus, consisting of a hand-driven dynamo, delivering an alternating current, at an average pressure of about 60 volts, and a signal-receiver, consisting of a pair of polarized electromagnets, so set in relation to a movable polarized armature that an attraction or repulsion exerted thereon by either of the electromagnet poles would result in a to-and-fro motion of the armature. An extended portion of the armature was pro-

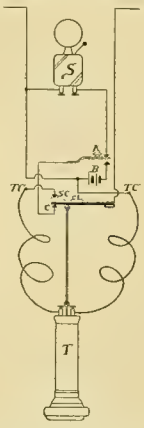

FIG. 2. EVOLUTION OF THE LINE SIGNAL.

vided with a hammer-like arrangement for alternately striking each of the gongs.

Though it is true that there has been during the last year a marked tendency toward reverting to the use of a direct current for signaling purposes, it can only be applied with good results to systems wherein the calling stations are located within perhaps a one or two-mile radius of the central office; moreover, the calling battery must, necessarily, be centralized, which fact alone would prohibit satisfactory service on toll-line systems.

Among many, one of the first duties imposed on the magnet electro-generator was the signaling of a large number of bells located in an equal number of distant telephone stations. Referring to Fig. 3, we have a diagram showing what is known as the series-connected telephone circuit. The system of connection shown differs from a simple telephone circuit, in that while any two stations are in communication the telephone or voice currents are obliged to force their way through the entire circuit. The mere ohmic resistance of a telephone line does not seriously obstruct the passage of voice currents, and were it not from the fact that all circuits possess properties not wholly governed by ohmic resistance, transcontinental telephony would long to have been an accomplished fact.

In the system shown, it will be observed that in order to complete the telephonic circuit the voice currents must pass through the signal-receiver of every idle telephone station. Now, when it is remembered that the average 80-ohm magneto ringer

Fig. 2.

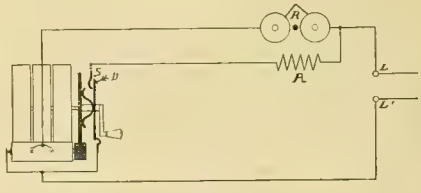

Fig. 3.

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offers a resistance to the voice currents equal to a line wire of about 10 times the resistance, it can be readily understood why there is a limit to the number of telephone stations that can be successfully operated on a circuit, when all signal-receivers form an obstruction to the passage of the voice currents. In the series telephone circuit, however, the magneto-generator gives a fairly satisfactory service, inasmuch as the limit of transmitting speech over a given circuit is reached long before the limit of signaling.

After a few years of experimenting and practical experience, telephone engineers began to realize that in order to make a commercial success of interstate toll-line service, something radically different from the series-connected telephone would have to be devised. As a makeshift, three wires were used; one, employing the earth as a return, was for signaling, the other two being for communicative service. The three-wire system of construction, though somewhat more expensive, gave sat-

isfaction, as compared with the service rendered by a series system. However, it was deemed advisable to devise some plan by which the two wires alone could be made to serve for signaling and talking.

Time and again ordinary series telephones were connected, one terminal to each of the unbroken and continuous talking wires. While this plan of connecting gave a fairly satisfactory service for a limited number of instruments, on short lines, it was found that the magneto-generators did not supply a sufficient quantity of current to sound all of the bells of the remaining instruments; and, again, on attempting to make the ringers more sensitive by making them larger, or, what amounted to the same thing, putting on more turns of wire, it was found that this made matters worse, being due, of course, to the fact that the generators failed to deliver a sufficiently large current, by reason of the additional resistance introduced through making the ringer magnets of a high resistance.

Early in 1888 John J. Carty of the New York Telephone company built instruments based on a plan which proved to be an immense stride toward overcoming the previous difficulties encountered in employing a two-wire talking circuit for the additional purpose of transmitting signals. The plan, as outlined by him, consisted in connecting the magneto-bells across both sides of the unbroken pair of talking wires. The magneto-generator was connected likewise, with the exception that it was normally left on an open circuit, and only connected to the pair of talking wires when it was required for the purpose of transmitting a signal. This plan of construction apparently gave the best results, though before it had been placed on a practical basis of operation it was found necessary to provide against the ringer magnets short-circuiting the talking wires, which was done by increasing effects already observed in the early series telephone circuits, where, as already mentioned, it was found that the ringer magnets offered about 10 times as much resistance to the passage of voice currents as would be represented by its ohmic resistance. Carty exaggerated this well-known phenomenon by increasing the length of his ringer magnets, as also increasing the number of turns of wire wound thereon. Continuing his experiments, Carty applied the ordinary telephone generator to his unbroken talking wire, across which a comparatively large number of the specially high-wound magneto-bells had been connected. It was then found that the generator was not strong enough to deliver a sufficiently large current for properly sounding every bell on the circuit. Applying the well-known law, that if one piece of apparatus absorbs a certain amount of energy, 20 such pieces of apparatus would absorb 20 times the amount of energy, it was found necessary to supply a larger quantity of current than could be produced by an ordinary magneto-generator, which may have been wound for delivering current at a pressure of, say, 60 volts; but its internal resistance was about 600 ohms; therefore, in order to force a sufficiently large current through each of the ringer magnets, it became necessary to reduce the internal resistance, or to increase the electromotive force. Inasmuch, however, as a higher electromotive force could not well be supplied, Carty discovered (?) that a reduction of the internal resistance in the magneto-generator produced the desired results.

Practically the bridging method of connecting party-line telephones fills every requirement. When employed for party-line work the number of instruments which may be connected to one circuit is governed only by the amount of available current for transmitting a call signal; thus, if we have a circuit of a given length and we have a given number of instruments connected in bridge or parallel, we need only to place the properly proportioned magneto-generator at each station and render a satisfactory service. For very long-distance service, however, and with high-resistance lines the problem of supplying suitable instruments becomes more difficult, for it will be necessary to maintain a comparatively high electromotive force in order to supply the most distant signal-receivers with the proper amount of current. Roughly, taking the 1,000-ohm ringer, a signal transmitter when operated at any station of the circuit must generate a sufficiently high electromotive force for producing at least one volt difference of potential at the most distant signal station; thus it will be understood that in designing an equipment for a given toll-line circuit the problem resolves itself into a question of volts and amperes, or rather milliamperes, for the amount of current required to operate a magneto-bell wound with no less than 6,000 turns of wire around each pole-piece is exceedingly small.

A recent addition to the art of manufacturing telephones for connecting in parallel with an electric circuit is shown by Fig. 4. It represents what appears to be an ordinary series-connected telephone, which, in fact, it is, with the difference that the magneto-generator is wound so as to produce a large current output, and the ringer magnets are wound to a resistance of 1,000 ohms. Leaving aside other features and connecting the telephone by means of the binding-post L and L', it will be observed that when the generator is operated, the current must flow through the 1,000-ohm bell magnet before it can pass out through the line binding-post; thus, we have produced an instrument similar to the well-known type of series wiring, and a very inefficient type at that, for, as has been mentioned, the generator is wound for a large output of current and a comparatively low difference of potential, whereas the ringer magnets are wound to a resistance which effectually bars the passage of all but a very small portion of the current generated. While receiving the signal at the station, it will be observed that only the ringer magnet would be in circuit, as the magneto-generator is supplied with means for automatically cutting itself out of circuit. As it stands, this instrument would be suitable only as a signal-receiver when used for bridging work. However, referring again to the diagram, it will be observed that there has been placed a small spring S, and a shunt coil A, one side of the shunt coil being connected to the outer terminal of the ringer magnet, and, inasmuch as the inner terminal of the ringer magnet is connected to the magneto-generator frame, it is obvious that when operating the magneto-generator the automatic short-circuiting shunt being broken, the current will begin to flow through the ringer magnets; at the same instant, however, the disk D, forming a part of the magneto-generator frame, would make contact with the spring S and produce a second path for the generated current; this path being, as already described, through a very low-resistance shunt coil A, and out on the line. It will be observed that with an open circuit the high-wound ringer would not be sounded, nor would there be any waste of current. On short-circuiting the binding-posts L and L', the generated current would flow in parallel through the ringer magnet R and the shunt coil A in proportions governed by their respective resistances. In practice the shunt coil A might be wound to a resistance of 75 ohms, or, for the sake of clearness, 50 ohms. It will be apparent that only five per cent. of the current generated will pass through the ringer magnets R. In other words, no current is wasted in sounding the local bell unnecessarily loud, and inasmuch as the shunt coil A consists of a non-inductive resistance, it offers a ready path for the current. From a practical standpoint this feature alone is especially desirable, for, as is well known to all telephone engineers, one of the most objectionable features of the Carty type of bridging bells is that the full electromotive force of a generator is allowed to act on the local ringer, producing therein a polarizing sticking or freezing effect, which makes it difficult at times to sound a particular bell when the received current is not very strong. This freezing effect cannot be produced in the new type of telephone, for at no time can the full electromotive force of the local generator be made to act on it. The contention may be made that the station nearest to a calling station can impress its full electromotive force on the nearest magneto-bell, but, even admitting this, it must be remembered that when a particular bell armature sticks or is frozen fast, so to speak, it is again depolarized the moment a local user operates the magneto-generator for the purpose of calling some other station. This is a feature not possessed by the Carty type of wiring, and it is of such importance in practical service that it should not be lightly considered.

Telephony Abroad.

The Oriental Telephone and Electric company, limited, of London has declared an interim dividend of 4d. per share, free of income tax, payable to shareholders whose names were on the register on October 26th.

The British postmaster-general has informed the Huddersfield corporation that he will be prepared to grant that body a telephone license on the necessary powers being granted it by Parliament. As in the case of other applicants for similar franchises, he declares that a condition of the license will be that it will expire in 1911.

The eighth report of the directors of the Venezuela Telephone and Electrical Appliances company for the year ended June 30th shows a profit of £9,942 0s. 8d., to which is added £744 3s. 4d., brought forward. After providing for interest on debentures and dividend on preference shares, there remains £5,499 2s. 7d., and the directors recommend a dividend at the rate of four per cent. per annum on the ordinary shares, absorbing £2,800; that £1,500 be written off; that £500 be carried to reserve, and that £699 2s. 7d. be carried forward. The amount invested in extensions and improvements during the year was £1,754 8s. 1d., against £8,423 8s. 7d. for the previous year. On June 30th, the number of subscribers was 2,640. During the year commerce in Venezuela experienced considerable difficulties, as an outbreak of smallpox in some districts seriously affected business.

A unanimous resolution has been passed by the Manchester City Council recording its opinion that it is not desirable to continue the present monopoly of telephone service in the hands of the National Telephone company. The corporation regards competition as essential to a cheap and efficient service, whether secured from another private company or from the Postoffice, or, in the last instance, from the corporation itself in the form of a municipal exchange. A deputation from the Manchester corporation waited on the postmaster-general, and asked that official to grant a license to the New Mutual Telephone company. The Duke of Norfolk replied that under no circumstances would the department grant a license to the New Mutual company, or to any other new company, and he did not know whether the Postoffice would erect an efficient exchange to provide the competition required. An emphatic negative was given to the question whether, in the event of the corporation erecting an exchange, the Postoffice would give an extension of the license beyond 1911—the time fixed in the Treasury minute for the termination of the license of the National Telephone company—and, moreover, no promise could be given as to whether the Postoffice would purchase such an exchange at a fair valuation in 1911; the consideration of such a point, it was said, must be left to Parliament.

The Telephone Users' association of Norwich is circulating a letter among other English towns, asking for co-operation in securing legislation upon the telephone question. The letter says: "It is evident from the fact that licenses have been granted to Glasgow and Huddersfield that the government does not intend to take over the telephones, but to grant licenses to municipalities or to companies under their control, in accordance with the terms of the Treasury minute of May, 1892. This will entail upon every corporation anxious to have the control of the telephone exchange the trouble and inconvenience of obtaining a special act of Parliament for its own particular locality. What is wanted now is pressure to be brought upon the government to bring in a general enabling act, whereby municipalities will be able to immediately take up the telephone business and work it in suitable areas, the extent of which ought to be at once under the consideration of every municipal authority. The chief point that requires the consideration of each town is, What extent of area suits the surrounding neighborhood?" It is evident that the promoters of this movement are anticipating the action of the government, as licenses have not yet been granted to Glasgow and Huddersfield. The policy of the government on the telephone question has not yet been defined, although the postmaster-general has signified his wishes in the matter. It is contended that a general enabling act would be harmful, as some towns might be induced to engage in the telephone business which cannot possibly make it pay. If such a movement as that outlined in the circular should gain headway it would greatly complicate the subject and add many embarrassments to an already badly mixed matter.

Extensions and Improvements.

An ordinance has been presented to grant the right to W. B. Ogden to establish a telephone exchange in town of Hoquaim, Wash.

The Rock County Telephone company will apply to the City Council of Janesville, Wis., for a franchise to operate a telephone exchange.

Arrangements have been completed for the extension of the telephone system from Pomona, Cal., to San Dimas, La Verna and other points.

The New Westminster and Burrad Inlet Telephone company has been succeeded by the British Columbia Telephone company. It is the intention to extend the system wherever opportunities offer. W. H. Kent is construction superintendent and manager of the new concern, with headquarters at Vancouver, B. C.

All negotiations have been closed between the Oregon Telephone company and the Santiam Telephone company for the purchase of the latter's line, which connects Salem with Turner, Aumsville, Sublimity and Stayton. The former company expects to have telephones in every city in Oregon before many months pass.

G. B. Bush, master of construction for the Sunset Telephone company, is examining the route of the line from Bandon to Gold Beach, which is to be built at once. Mr. Bush states that the company will soon put up a line between Marshfield, Ore., and Roseburg, thereby connecting Marshfield with Portland and San Francisco.

The Isle of Wight Telephone and Telegraph company has been incorporated at Suffolk, Va., for the erection of a telephone line between Suffolk and Smithfield, and to connect with the Southern States Telephone company. J. W. Thomas of Smithfield is president; J. U. Burgess of Suffolk, vice-president; J. W. Holliday of Smithfield, secretary and treasurer, and W. N. McAnge of Suffolk, general manager.

The Germantown, Minerva and Maysville Telephone company of Germantown, Ky., has filed articles of incorporation, the incorporators being J. F. Walton, S. D. Rigdon, T. M. Dora and Evan Lloyd of Germantown, and C. L. Sallee, M. C. Russell, Isaac Woodward and John C. Adamson of Maysville; president, J. F. Walton; vice-president, C. L. Sallee; secretary and treasurer, Isaac Woodward; general manager, S. D. Rigdon.

The Bell Telephone company has materially improved its system in and about Massillon, Ohio, by completing a new metallic circuit connecting Justus, Wilmot, Millport, Beach City and Navarre with the Massillon exchange. Further extensions are contemplated which will include New Lisbon, Winesburg, Bolivar and Zoar. A line has also been extended to Somerdale, and eventually Sherodsville and Leesville will be added to the list. The local manager has closed the contract for the construction of a private line between Wooster, Orrville and Massillon, and the work of rebuilding toll lines between these places has been undertaken.

New Lakon Transformers.

The Lakon company of Elkhart, Ind., has recently placed on the market a new line of transformers. These transformers are of the oil type, and, although they may be used without oil, the company strongly advises the use of oil in all sizes, as the oil aids in the dissipation of heat and prevents deterioration of insulation due to high temperatures. A pair of strong and simple all-porcelain fuse boxes is furnished with each transformer.

The method of hanging is extremely simple. The light Lakon hanging hook can be held in position and the lag screws and bolts put in place by one man with ease, and when the transformer is hoisted to be hung upon the hook it can be swung into position and quickly and easily lowered into the hanging hook.

A transformer having a high full-load efficiency will not necessarily have a high all-day efficiency, and it is the all-day efficiency which is important. In order to secure a high all-day efficiency the transformers have been designed for a very low-core loss, and good regulation is secured by a symmetrical arrangement of the windings and a liberal use of copper. The primary and secondary cables are brought out on opposite sides of the case through heavy porcelain bushings, and are firmly cemented into the porcelain so that there will be no chafing or wearing away of the insulation where the cables come through the case.

The aging of iron has been carefully investigated by this company and it will replace within two years any transformer that shows any marked change in efficiency due to aging of iron.

In the Lakon transformer the coils are so arranged that a very large surface of copper is exposed to the oil, so that the temperature is kept down to a low figure.

The transformers are designed to withstand a very high breakdown test between primary and secondary and between primary and core. While a very high insulation between primary and secondary is a safeguard against burn-outs from lightning, a transformer cannot be made in which the insulation in itself is enough to withstand the extremely high potential of a lightning discharge, and the company advocates a more general use of lightning arresters. Metallic ground shields will be placed in the transformers when specified, but the company does not advise the use of them on account of the increased danger of a puncture in the insulation, due to a lightning discharge. The ground shield, being connected to earth, affords a free path for lightning, and the manufacturers believe that the transformer is more liable to be burned out by lightning when ground shields are attached. The ground shield will prevent the lightning discharge from appearing on the secondary circuit, but it is not a protection to the transformer.

This company manufactures transformers for alternating-current arc lamps, step-up and step-down transformers, and transformers for special purposes, such as electro-cautery, electro-welding or testing.

Referring to the accompanying illustration, Fig. 1 shows a 7½-kilowatt transformer complete; Fig. 2 represents the coils of the same transformer; Fig. 3, an interior view of the Lakon type; Fig. 4, the rear appearance of the case, showing hanging device; Fig. 5, fuse box, and Fig. 6 a row of transformer coils of 7½, four, 1½ and one-half kilowatts capacity respectively.

The company has published a booklet entitled "The Lakon: A Book for the Busy Man, on Alternating Currents and Transformers." A unique feature of this booklet is a description of the principles of alternating currents, with special reference to their application to transformers.

Fig. 1.

Fig. 2.

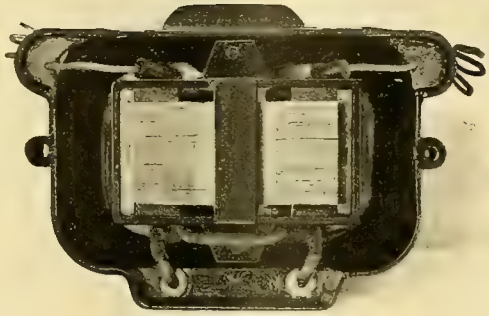


Fig. 3.

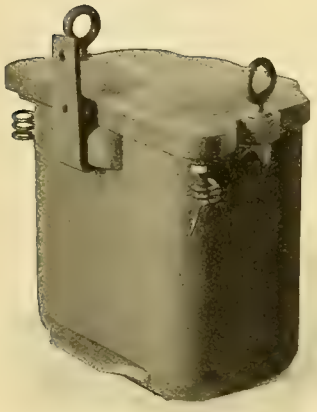


Fig. 4.

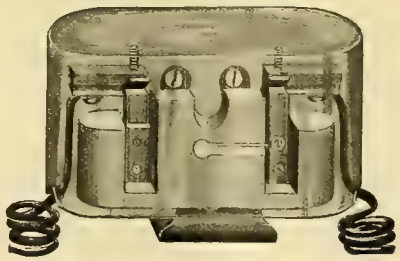


Fig. 5.

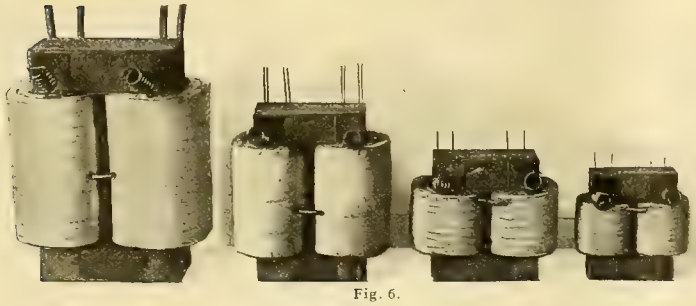


Fig. 6.

NEW LAKON TRANSFORMERS.

Snoqualmie Falls Transmission.

The work of installing the plant to transmit power from Snoqualmie Falls to the cities of Seattle and Tacoma is now well advanced toward completion, although it was considerably delayed by the failure of the plan to turn the stream through the vertical shaft and tail-race, at low water, in order to build the dam across the river expeditiously. This plan was briefly referred to in the description of the work in the Western Electrician of August 20th. The idea was to divert the course of the river through the shaft and tunnel while the dam was building, the falls running dry. This was attempted at low water, but the shaft had not been excavated to its full size (eight by 25 feet) all the way down, and, despite the enormous head of water—250 feet—it became clogged by timbers and practically no water flowed through the tunnel outlet. Attempts were made to destroy the obstruction by exploding charges of dynamite, but without effect. An effort was made to pump out the shaft, but that, too, was abandoned. Finally, Mr. Charles H. Baker, who is president of the company, decided to use an artesian-well drill. This idea was carried into effect and was successful, an opening being made for the water, which swept out through the tunnel, carrying every obstruction with it. But in the meantime the water in the river had risen, so that the original plan could not be carried out. The dam was partially built and will be completed by the use of cofferdams. This mishap set the work back three or four weeks, but the construction is being pushed with vigor. One generator has been shipped from Pittsburg, and the work of stringing the aluminum wires is under way. Much of the steel pipe for the water columns down the shaft is on the ground, and, while much remains to be done, it is expected that current will be sent over the line within two months.

The plant will be a very interesting one when completed. It will electrically transmit 6,000 horse power to the cities named over circuits of aluminum wire, the distance of transmission being 30 miles to Seattle and about 44 miles to Tacoma. The power generating plant will be in a subterranean chamber at the bottom of the shaft 200 feet long, 50 feet wide and 25 feet high, and 250 feet below the surface of the earth at the top of the falls. The tunnel leading from it is 15 feet in diameter and 660 feet long. There will be four water-wheels and four 1,500-kilowatt three-phase generators. The line voltage will be about 25,000 volts.

A franchise has been secured by the company to use the streets of Seattle, but considerable opposition has been encountered in Tacoma, where the City Council is disposed to make very onerous conditions. In the latter city a franchise has been offered to Mr. William T. Baker of Chicago, who is the principal stockholder of the company, but he has not accepted it. After long deliberation the aldermen offered to grant to Mr. Baker permission to erect poles and string wires in the city of Tacoma subject to the regulations and control of the commissioner of public works and the city council, the city, however, reserving the right to compel the laying of wires in conduits at any time. The poles or conduits must be of sufficient size to admit of their use by the city free of charge or by any other company to whom the city might subsequently grant a franchise, at not to exceed cost. It was also stipulated that such excess capacity should not be used except as stated. The charges allowed under the franchise should not be greater in Tacoma than at any other place five miles distant from the power plant. The company would be required to furnish power to the city at not to exceed 1¼ cents per kilowatt-hour but the city would not be required to take it. The company, under the franchise, would be compelled to deliver to the city, on demand, 3,000 horse power by August 1, 1899, and 5,000 horse power by August 1, 1900, otherwise forfeiting the franchise. There was also a provision to prevent the company from entering into competion with the city in the matter of lighting.

In refusing to accept this franchise Mr. Baker wrote an interesting letter to the mayor and aldermen, stating very clearly his position as an outside investor. The letter is rather long, but as the general features of the relations of city governments and private investors are alike in all cities the greater part of it is given:

When the project of developing the water power of Snoqualmie Falls was brought to my attention about a year ago, it was represented that, if I would advance the money to make this development for the benefit of Tacoma and Seattle, liberal franchises and rights of way would be granted in both towns on any reasonable terms that I might request. It was suggested at the time that I begin the development in good faith first, and when, by the investment of considerable money, I had shown my disposition to carry the plan into effect, I should then ask for franchises and the same would be promptly granted. I have from the start been met with a general opposition in both cities, contrary to what I had been led to expect, which, if I had foreseen, would certainly have deterred me from investing a dollar in your country. I was informed that this project had for several years been the cherished hobby of the two cities, and several unsuccessful attempts had been made to promote it; that the successful promotion of it would be hailed as the harbinger of a new era of industrial development in the cities. Thus assured of the support and goodwill of the citizens, without asking any bonus or guarantee, as is usual with enterprises experimental in nature and remote from populous centers, I began a large expenditure of money upon the suggestions offered, looking to the harnessing of a water power, which as yet I have never seen. It has been claimed by a prominent electric manufacturing company that it would prevent the granting of franchises to me in either city. I looked upon this as an idle boast, as I could not see how any concern could have any such hold upon an independent community.

I have accepted in Seattle a franchise, the harshest perhaps that has ever been granted in any city to an individual or corporation, and this I did because my investment had already piled up too high to recede. There is, however, no reason why I should accept even a harsher one at your hands, and I think I

can show you that no business man having a due regard for the safety of his capital would care to invest any money under the franchise that you offer, when there are opportunities for safe and profitable investment near at home.

I respectfully call your attention to the following exceptions which I take to the ordinance:

Sec. 5. Here you state that the reservation of additional space on the pole lines and conduits may be used by the city for any purpose, free of charge. This is eminently unjust and contrary to public policy for a competitor of mine to use my own property without paying for it in order to compete with me in the same business. It would be proper for the city to have the use of my pole lines for municipal purposes; that is, for lighting the streets and public buildings.

Sec. 10. It is stated that the rates to be charged for power shall be no greater than may be charged at a point five miles or more from the generating station. This is eminently unjust. Power at five miles distance can be produced without the intervention of step-up and step-down transformers and with comparatively

NEW GORDON TRANSMITTER ARM.

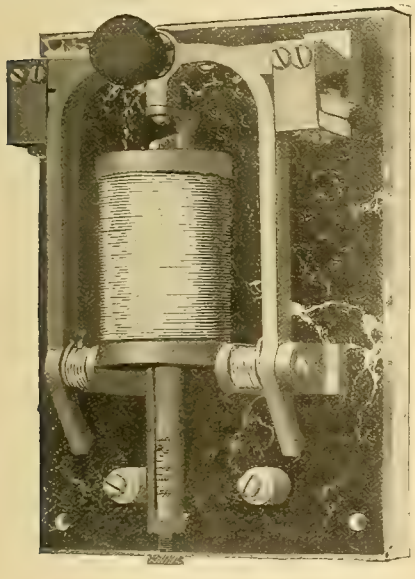
little investment in pole lines, in addition to which, however, the loss by transmission will be only one-ninth of what it is to your city, and yet you ask that the charge to your city be made the same, and I frankly tell you this is impracticable.

If the idea is to compel the same basis of charges in Tacoma as will be inaugurated in Seattle I could accept the condition, although even under that condition it would not be profitable as business in Seattle, on account of the greater distance and the tax you impose upon the product. It is also stated that I shall be required to furnish your city power for any purpose at 1¼ cents per kilowatt-hour. There is, however, no reference to the amount of power the city will consume during twenty-four hours. I am informed in this connection that although the maximum load is large, the average load is smaller than in most plants. It is stated that the load factor is as low as 15 per cent, which, if true, would mean a considerable loss to me in addition to the other penalties imposed. Without an agreed load factor, therefore, of say 40 per cent, this clause would condemn it.

It is also required that 3,000 horse power shall be available in Tacoma, under this grant, August 1, 1899. I could not be bound to this limited time, as the rainy season is near at hand and construction will, in consequence, soon have to be abandoned until dry weather again. The date should be December 1, 1899.

Sec. 11. Here you reserve the right to acquire by condemnation the rights under this franchise and the property and business that my investment in your city may have led me to acquire, and this in three years' time. I have had no thought of making this investment for the purpose of selling it. I am not looking for a short-time investment, but am looking for a permanent investment with reasonably sure returns.

I could not, therefore, agree to make this investment in your city with the right of the city reserved to take it from me at any



LA ROCHE CIRCUIT BREAKER.

time, and particularly at a price to be determined by arbitration.

Sec. 15. This article proposes a system of taxation upon the receipts of the company. The ordinance requires that I shall furnish power in Tacoma at the same rate as in Seattle, although I go fourteen miles further to do so and thereby lose seven and one-half per cent of my power in accomplishing it. The first five years you propose to tax me one per cent as against nothing for the first six years in Seattle.

I do not take exception to this, as I am advised that it is a charter requirement. At the end of six years the tax in Seattle is made one per cent for eighteen years, and at the end of that time may be increased or reduced or abolished; whereas, you begin to tax me two per cent in five years and increase it up to five and even more with the increase of business. I am not aware that there will be margin enough in the business to warrant my going after it with this penalty attached.

The aldermen refused to modify the ordinance to accord with Mr. Baker's views, and the franchise question is still unsettled.

Power-circuit Enclosed Arc Lamp.

Following next in the line of enclosed arc lamps developed by the General Electric company, a substantial, simple and efficient power-circuit lamp has been perfected for use—two in series—on 220-volt circuits, or five in series on 500-volt circuits. In outward appearance it resembles the alternating and direct-current carbon-fed enclosed arc lamps of the same company, and is manufactured in both single and double-globe types.

To conform to insurance regulations covering the use of arc lamps on high-voltage circuits, a safe, positive and reliable cut-out is incorporated in the lamp, together with an extra set of resistance coils. Should the carbons stick or the lamp for any reason fail to operate, the cut-out sends the current through these subsidiary resistance coils instead of through the carbons, without detriment to the lamp. The efficiency of this cut-out has been demonstrated by cutting out lamps in circuit and allowing them to remain cut out for several consecutive hours, without resultant injury either to coils or lamp.

The mechanism is simple and made up of but few parts. The carbon is fed by a double-cam clutch, smooth and positive in action. An adjustable resistance in the upper part of the lamp allows it to be employed two in series on circuits of 200 to 240 volts, or five in series on circuits of 500 to 600 volts. With one 12-inch positive and one 5½-inch negative carbons, it burns with one trimming for from 120 to 150 hours, and after the run the remainder of the positive carbon can be used in the lower carbon for a second run of equal duration. The current required is five amperes.

The lamp is furnished with the globe-lowering device, which has been fitted to over 30,000 General Electric enclosed arc lamps, and which permits the globe to be lowered gently by merely turning a milled thumb-screw at the side of the casing. The globe holder is locked automatically by a single upward movement of the globe holder. Power-circuit lamps are furnished in weatherproof, black or brass casings. The cut shows the weatherproof casing.

Electric Toy Engine.

The electric toy engine shown in the cut is made by M. Davis & Sons of Salem, Ohio. It is attractive, double-acting, and has an ingenious parallel motion for controlling the piston movement. It is intended to be run on current supplied by any kind of battery or on electric-lighting circuits by placing a lamp in series with it. It is neatly boxed, and contains directions for operation.

ELECTRIC TOY ENGINE.

New Gordon Transmitter Arm.

The cut herewith shows a novel and very simple long-distance telephone transmitter arm recently invented, patented and now being manufactured by A. Y. Gordon, general manager of the Farmers' Telephone company of Massilion, Ohio.

The picture shows in itself the most valuable points in this transmitter arm. It is what might be called "universally adjustable," in that the arm can be raised, lowered or swung laterally instantly to suit the user. But its most valuable feature and the one that commends the arm to the general telephone trade is due to the fact that no matter what may be the position of the arm proper the transmitter itself, owing to the weighted and counter-balancing handle (shown in the cut), always remains in an upright position ready for service.

La Roche Circuit Breaker.

The cut presented herewith illustrates a new type of single-pole circuit breaker manufactured by F. A. La Roche & Co., New York city.

This circuit breaker is also made with over and under-load attachments for motor work.

It is especially adapted for high voltages ranging in the neighborhood of 2,000 volts, and is guaranteed to break 2,000 volts successfully without arcing at the clips.

This feature is accomplished by the method in which the carbons are attached to the breaker. It will be noticed that the carbons are parallel to the clips, and as the breaker opens the carbon attached to the blades opens with a cam motion, which keeps a rubbing contact on the stationary carbon until the blades themselves are well out of the clips and at a safe distance; then the circuit is finally broken through the carbons and below the clips, so that no burning of the clips or blades can possibly take place.

The blades are of the wedge type and close into V-shaped clips. These are laminated and flexible to an extent so that they adapt themselves to the shape of the blades, and an absolutely tight contact is thereby formed.

The latch and trigger are made of case-hardened steel and are of the compound-lever type, so constructed as to permit of a very weak solenoid being used, as the force of the blow required to operate the breaker will be very small. This method of construction is new in this style of instrument.

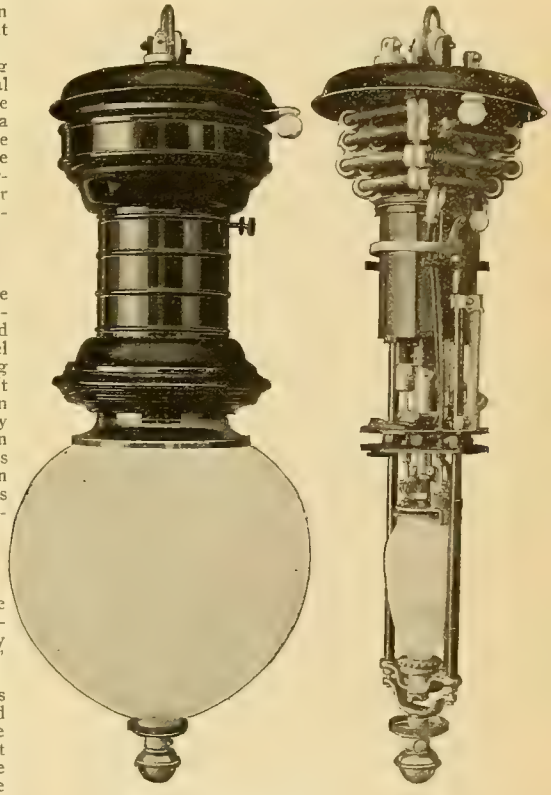
The hinge-posts and blade-arms do not carry any current, and it will be noticed by referring to the cut that there are two phosphor-bronze springs in each hinge. These springs are quite weak and only sufficiently strong to give the switch a sharp and quick break. Owing to the peculiarly shaped blades and clips, it is an absolute impossibility for the circuit breaker to stick, and the construction of the clips tends to throw the blades out of their own account. This breaker would really operate without these springs in the hinge, the springs being there only to assist in quickening the motion.

On the bottom of the lever arms are two projections which are parts of the blades' frame, and come in contact with a buffer, so that when the breaker is opened and performing its function, the blow on the hinge-post is reduced to a minimum.

Underneath the solenoid is a copper tube upon which is marked the calibration in amperes and fractions thereof. Upon the end of this tube is a milled-head screw and nut, which admits of adjusting the circuit breaker to open at any desired point within its guaranteed high and low-ampere ratings.

The instruments are mounted on white marble or marbleized slate bases, as may be desired, and require no remounting, as each breaker is provided with binding-posts. They will operate in a box or panel board, requiring only five inches depth, and it is simply necessary to run a wire to the binding-post without any other connections or mounting.

Special care is taken to calibrate these instruments, and they are said to be as reliable as any standard amperemeter and are made in sizes from 15 amperes up to 500 amperes.



POWER CIRCUIT ENCLOSED ARC LAMP.

Insulating Substances from Fish Oil.

The utilization of fish refuse for the extract of oil has never been successful in France, but in England not only has oil been successfully recovered from such remains, but a heavy oil rich in insulating qualities, has been extracted from fish guano. This oil costs next to nothing, and has a considerable commercial value. It is available for all electrical purposes, and may be converted by pressure into slabs for dynamos, transformers, switchboards. It has been made into pulleys, wagon wheels, railroad ties and coach bodies. Objects of art have been manufactured from it, which neither temperature nor humidity affected.

Fibrous manufactures impregnated with this heavy fish oil and treated similarly to the same kind of insulating materials, are said to be superior to vulcanized fiber, and may be substituted for hard rubber. The oil costs about 600 francs per ton, and sells at 3,500 francs.

For several months, says Andréoli, in l'Electricien, we have ozonized fish oils, which were much improved in color, fluidity and odor. Ozone may be made to change these oils to a condition bordering on semi-solidification. Much, it would seem, is possible in that direction. There are several methods of manufacturing substitutes for caoutchouc and ebonite from siccative oils, and fish oils, after having been thickened by ozone, in the hands of specialists, may enjoy an important role in the insulating industries where durability, impermeability and resistance to high electrical tensions are prerequisites.

Electrical Invention.

A paper was read recently before the electrical section of the Franklin Institute, on "The Status of Electrical Invention," by William A. Rosenbaum of New York. The speaker adopted the technical meaning of the word "invention" instead of the popular acceptation of the term. Each of the main branches of the science of electricity was taken up in turn and the inventions which have been responsible for, or have directed the lines of, its development were considered. Thus, in the building up of a branch of the art, certain inventions appear from time to time, from which spring new lines of development or improvement, and these, which the speaker termed the "milestones in the progress of invention," were briefly described and their proper places in the art located.

In telegraphy special mention was made of the needle telegraph, the Morse key, relay sounder and register, the repeater, the duplex, quadruplex, the dynamo quadruplex-key system, the multiplex, the writing and printing telegraph, telegraphing from moving trains, the submarine telegraph, the synchronograph and the wireless telegraph.

In telephony the inventions mentioned were the receiver, the microphone transmitter, the induction coil, the magneto call, the automatic switch, the switchboards and the repeater, the last noted as a device to which considerable attention has been given by inventors, without achieving success.

After brief mention of the work of early investigators in the field of arc lighting, the list of leading inventions was given, containing the shunt circuit and the differential lamp, the clutch, the double-carbon lamp, the enclosed arc lamp and the focusing lamp. In incandescent lighting the speaker asserted that the art was substantially perfected with the discovery of the first commercial lamp and the "three-wire" system of distribution, both the work of Mr. Edison. Other electric-lighting inventions which received attention were the vacuum-tube system and the X-rays.

In the development of the dynamo, Faraday's machine came first; then followed a machine giving alternating currents, then the commutator, the self-exciting machine, the laminated armature, the machine without moving wire, the shuttle armature, the shunt-wound machine, the Paccinotti ring, the Gramme ring and compound winding. Under the head of electric motors, the polyphase motor was especially mentioned.

Under chemical generation and storage of electrical energy, types of primary and secondary batteries were described.

The electric railway made its first appearance in 1837, in the shape of a model built by a Green Mountain blacksmith by the name of Thomas Davenport. The leading inventions were the connecting of the motor on the vehicle with a stationary dynamo, the overhead wire and trolley, the sub-trolley and plow, the controller, the carbon brush for the motor, the hinged and spring-mounted motor and the slow-speed motor.

The paper closed with the prophecy that "wireless" telegraphy now being a fact, we shall, ere long, be able to telephone without wires, have electric lights without wires, ride in electric cars propelled by electricity delivered thereto from a stationary dynamo without connecting wires, and transmit electric power, in general, without wires. As to the last, the fact was noted that Tesla has very recently accomplished the transmission of current on a large scale through the rarefied regions of the atmosphere.

Electrical Development in Jackson, Miss.

Jackson, Miss., has suffered from the yellow-fever scare. The correspondent of the New Orleans Picayune at that place says that "the worst blow Mississippi has been struck has been by its own people," meaning that great injury was done to the state by the unwarranted exodus to Chicago. However, electrical improvements of importance are promised in Jackson. The following account was written from Chicago by Mr. Edgar S. Wilson, the correspondent in question:

"It will be gratifying news to the people of the state, and especially to the people of the capital city, to know that Jackson will, just as soon as the quarantine turns her loose, have a first-class electric street railway and an electric-light plant. The Jackson Electric Railway and Power company, which was granted the franchise for these enterprises, only awaits a telegram from Mayor Wharton, telling the officers of the company to 'come on,' for work to begin. In fact, its officers are growing impatient; they want to begin work and would not wait for the raising of the quarantine if they could only get through the state with their men and machinery to Jackson. This company will spend $125,000 in the capital city within the next 90 days, and Jackson will no longer be a horse-car and moonlight-scheduled city. It will have a modern electric railway, and with 12 cars, six open and six closed, and an electric-light plant which will light the city from dark until daylight and furnish illumination for homes and business houses, as well as power for electric fans. And the machinery has been purchased; the old gas-plant in Jackson has also been bought by the new company, and this has been done, in fact, since the quarantine and the announcement of the fever, showing that Memphis capitalists have $125,000 worth of faith in Jackson the first dash out of the box. The old plant, also purchased by the new company, is not to be used by the new company, but a new electric-light plant, modern and up to date, is to take its place. In fact, all the machinery for the electric road and the new electric-light plant has been purchased and will be on the ground just as soon as King Quarantine will allow communication to open up."

CORRESPONDENCE.

New York Notes.

New York, November 14.—The practical consolidation of all the electric-lighting interests in Brooklyn was carried into effect to-day, when the Kings County Electric Light and Power company took possession of the property of the Edison Electric Illuminating company. The financial end of the consolidation was effected several weeks ago, and Kings County Electric bonds were transferred for Edison stock last month. The Edison company will not abandon its organization, but will maintain it to look after the interests of its stockholders and to see that all obligations to it are observed. The management of affairs will be entirely in the hands of the controlling company, however. The board of directors of the Edison company met last week and elected a new board, as well as new officers. Bernard F. Gallagher was elected president in the place of Ethan Allen Doty, and Henry Seibert vice-president in the place of Edwin Packard. The new directors are Messrs. Gallagher and Seibert, James N. Wallace, Daniel J. Creem, George A. Price, A. W. Dater, Thomas E. Murray, W. F. Sheehan, John G. Jenkins, Nicholas F. Brady, Horace C. Du Val, Royal C. Peabody and J. D. Fairchild. It is understood that the Kings County company will make some radical changes in the general management of the electrical affairs which it controls. Through the discontinuance of unnecessary power plants the management hopes to save $200,000 over what it formerly cost to run the two companies. Mr. Gallagher is a well-known Eastern District business man. He was at one time fire commissioner.

Curiosity is still excited by the mysterious New York Gas and Electric Light, Heat and Power company, lately incorporated with $25 000 000 capital stock. The plans of the new company and the names of the men controlling it are not publicly known, and our newspapers abound in rumors of great deals impending. A late story is that the new company has purchased a controlling interest in the stock of the Consolidated Telegraph and Electrical Subway company. The latter company leases the Empire City Subway company, the two having long been operated in common; but it is now reported that they will in future be operated separately, the consolidated company retaining control of the high-tension conduits used by the electric-light and power companies, and the Empire City company operating the low-tension conduits, in which the telephone companies' wires are laid. Capitalists believed to be interested in the New York Gas and Electric Light, Heat and Power company, however, deny that they are connected with either of the subway companies. "It is still the general belief," says the Tribune, "that the new corporation has been formed primarily with the object of consolidating the electric-light companies of the present city of New York, and that its first acquisition will be the Kings County Electric Light and Power company, which now controls practically the entire electric-lighting business of Brooklyn. It is also expected that this purchase will soon be followed by the taking over of electric-light companies in other boroughs. There is no indication as yet of an intention on the part of the New York Gas and Electric Light, Heat and Power company to absorb any of the gas companies."

The Woman's Health Protective association of Brooklyn has formally protested against the side-door street-railway cars. Complaint was made that passengers had to serve as conductors and open and shut the doors. Instances were cited of the impossibility of standing in the car and holding on to straps "only intended for giants," and of the number of wrenches received in wrist and knee while wrestling with all these inconveniences. A long list of colds and several cases of pneumonia and serious accidents were given as a part of the list of grievances.

Work has been begun on the large power house for the Queens Electric Light and Power company at Far Rockaway on property located at Carlton and Clinton avenues. The company has franchises for operating street railroads on the Rockaway peninsula, from Inwood to Rockaway Park. These lines, it is said, will be operated in connection with the Long Island railroad, carrying the residents of the Rockaway peninsula to one or two main stops, where connection will be made with fast express trains.

One effect of the changing conditions of street-railway traffic in this borough is shown by the annual report of the Manhattan Railway company. For the year ended September 30th there was a decrease of passengers carried, as compared with the previous year, of 3,456,285, the figures being 179,728,356 and 183,184,641. The annual meeting of the company was held on Wednesday last. There was no change in the directory. The net earnings of the year were $3,137,784, which is a decrease of $93,916 from last year. However, the dividends were reduced $150,000, so that $56,084 was added to the surplus, which now stands at $4,401,207.

The Middletown-Goshen Traction company, which had its office in this city, has passed into the hands of a receiver, Mr. W. B. Royce of Middletown, N. Y. The directors applied for a voluntary dissolution on the ground of insolvency. It was said that the company was unable to meet its fixed charges for interest on bonds, that there was no prospect for better business, that the stockholders are unwilling to increase the capital stock or advance money to the company, that there is a judgment pending against the company for $3,300 in favor of the city of Middletown which cannot be paid, and that there are other debts which cannot be met. The gross earning capacity is $500 a week. The assets consist of real estate, plant and equipment, valued at $201,275, all of which is covered by mortgages for $275 000. The floating debt outside of mortgages is $8,516, of which $654 is for wages to employes. The capital stock is $400,000, of which $275,000 has been issued.

The Society of Naval Architects and Marine Engineers held its sixth general meeting last week at the rooms of the American Society of Mechanical Engineers. Clement A. Griscom presided. The sessions were well attended. One of the papers was on "An Electrically Operated 150-ton Revolving Derrick," by Walter A. Post. Among those present were Chief Constructor Philip Hichborn, U. S. N., Constructors F. T. Bowles, J. J. Woodward and H. C. Smith, Commander Jacob W. Miller, Lieutenant W. P. White and other naval officers and Lewis Nixon.

M. S.

PERSONAL.

Mr. Edison denies the truth of the report from St. Petersburg that he is about to visit that city.

Professor D. C. Jackson of the University of Wisconsin was in Chicago last Saturday. He is an enthusiastic admirer of the Wisconsin football aggregation and still believes in them, despite their defeat in Chicago.

The marriage of Mr. Frank Nichols Phillips, second son of Eugene F. Phillips and president of the American Electrical Works of Providence, to Miss Edith Remington Peck, is announced. Mr. Phillips is receiving cordial congratulations from a very large circle of friends.

Edwin A. Kimball, an inventor and mechanical expert and formerly superintendent of the mechanical department of the University of Illinois, died on November 11th in Chicago. Mr. Kimball was born in 1834 in Orange, N. H. He removed to Danville, Ill., in 1873, and became an instructor in the mechanical department of the University of Illinois, where he remained for 12 years. During the last two years of his life he was connected with the Western Electric company.

ELECTRIC LIGHTING.

The City Council of Hagerstown, Md., has taken the initial steps to establish a sewerage system and an electric-light plant. The electric plant will probably cost $60,000.

H. V. Gates has submitted a proposition to the council of La Grande, Ore., for putting in a system of waterworks. His plan is to bring sufficient supply of water to furnish power to operate an electric-light plant, as well as a supply for fire protection.

A non-electrical contemporary points out that the Supreme Court explosion at Washington, which destroyed valuable archives that cannot be replaced, ought to admonish the judges that they have been entirely too slow in not lighting their subterranean apartments with electricity instead of gas.

Within another year Quebec, it is said, will be one of the best lighted cities in the world. It will have no less than three companies converting water powers in its vicinity into electricity. There will be the present Montmorency Falls company, the Chaudiere company, now in course of formation, and the Jacques Cartier Water Power company, which has already commenced to build at the falls of the Jacques Cartier River in Valcartier, some 18 miles from the city of Quebec.

Barrie, Ont., is determined to have cheap electric light, and will establish a plant of its own, unless the existing company sells out to the town at the town's valuation. But the council cannot raise money for the new plant without issuing bonds. To issue bonds requires the consent of the County Council. The County Council holds $10,000 stock in the light company as security for the deficit of an absent county treasurer, and naturally does not see the reasonableness of aiding a competitor starting in business.

ELECTRIC RAILWAYS.

A new syndicate has been formed to take the Fourteenth street franchise of the Oakland (Cal.) Transit company, recently abandoned. A petition to the council is being prepared. Local capitalists are interested.

C. P. Huntington, the president of the Southern Pacific Railway company, is considering the question of substituting electric for steam power on the railroads transporting passengers from the Oakland (Cal.) Mole to the various cities across the bay—

Oakland, Alameda, Fruitvale, Berkeley and others. L. D. Tandy of the General Electric company has been in San Francisco studying the engineering problem for Mr. Huntington.

Vice-president T. E. Gibbon of the Terminal railway at Los Angeles, Cal., states that the Glendale branch of the line will be electrically equipped. The Pasadena line will be operated in the same manner as soon as legal complications are settled.

As a step in the reorganization proceedings of the Metropolitan West Side Elevated Railway company of Chicago, an order directing the sale of the road at an upset price of $6,000,000 was entered by Judge Showalter in the United States Circuit Court on November 14th. Twenty days will be allowed for the redemption of the bonds and stock, and it is expected that the sale will take place in January.

Application will be made to the Legislative Assembly of the province of British Columbia at its next session for an act to incorporate a company with power to construct, equip and operate, by any kind of motive power, either a standard or narrow-gauge railway from a point near Trail to certain other towns and to the junction of the Salmon River with the Pen D'Oreille River, with power to construct branches, and maintain telegraph and telephone lines, in connection with the railway and branches. Galliher & Wilson of Nelson, B. C., are solicitors for the applicants.

Judge Grosscup of the United States Circuit Court has granted the petition of the "Monon" Railroad company for an injunction restraining the General Electric Railway company from laying tracks in Custom House court, Chicago. The petition of the Santa Fe company that the street-car company be enjoined from crossing its tracks at Fourteenth street was denied. Judge Grosscup, in deciding the Monon case, based his verdict on "grounds of general equity," adding that it was charged in the complainant's bill, and not controverted by the defendant, that insufficient frontage consent was in hand when the council granted the General Electric franchise. The decision stops track-laying operations in Custom House court until the United States Circuit Court of Appeals can review Judge Grosscup's decision. The General Electric Railway company has now a single track in Plymouth court, south to Fourteenth street, and thence to Dearborn, and a double track in Dearborn street south to within 100 feet of Sixteenth street, except at the intersection of Fifteenth street, and a double track in Custom House court, from Harrison street to Polk street.

POWER TRANSMISSION.

The Kalamazoo (Mich.) Valley Electric company, recently organized, has begun the construction of a dam in the Kalamazoo River, four miles from Allegan, Mich., by which it expects to develop 13,500 horse power. Four large water wheels will be put in, and the electric power generated will be distributed to Allegan, Kalamazoo, Otsego and other towns, for lighting and power purposes. The works are to be finished by next spring.

The Redlands Electric Light and Power company has filed claim to 4,000 inches of water flowing above the surface and underground in Mill Creek, the point of diversion being Aker's Narrows. The water is to be used to develop power to generate electricity and compressed air, drive machinery, produce light and heat, operate all kinds of transportation facilities, and for other mechanical purposes. The power will be transmitted from a power house up Mill Creek Cañon to all the important towns and cities in Riverside, Los Angeles and San Bernardino counties, Cal. The water will be diverted by means of a tunnel four feet wide and six feet high and a dam 300 feet in width and 10 feet high.

TELEGRAPH.

A telegraph line to connect Stockton and Tesla, Cal., is proposed.

Reports from all parts of the country indicate that the storms of the last two weeks have caused considerable damage to the telegraph system of the country.

The State Board of Appraisers has fixed the tax valuation of the telegraph companies in Ohio as follows: Postal Telegraph company, $306,693; Western Union Telegraph company, $2,100,087.

At Montreal a strike of the telegraph operators on the Grand Trunk railroad is feared. The men are organizing a union and will demand shorter hours and recognition of the organization. The railroad officials announced that they would not receive representatives of the union and would not recognize that body.

The Chicago Tribune has paid out this year over $51,000 on account of dispatches cabled from points where military and naval operations have been carried on. It points out that when Cuba, Porto Rico and the Philippines become territories of the United States the American papers will be receiving dispatches continually, and it is of the greatest importance that their cost should be reduced.

TECHNICAL SCHOOLS.

A chair of electrotherapeutics has been established in the medical college of the University of Buffalo.

One hundred and fifty members of the Western Society of Engineers inspected the engineering schools of the University of Illinois at Champaign on November 11th. The visitors were warmly greeted by the president of the college and a committee from the general faculty. Luncheon was served in the engineering building, and the afternoon was spent in inspecting the different engineering colleges. The members of the party were surprised at the magnitude and excellent equipment of the institution.

PUBLICATIONS.

'The Modern Roundhouse Turntable" is a Westinghouse pamphlet. It briefly recites the advantages of the application of electric power to turntables, and is naturally addressed particularly to railroad men. The Westinghouse company has devised a motor application for this purpose called the Westinghouse "turntable donkey," which seems to be simple and efficient, and, what is of much importance to railroad managers, this method requires no change in the turntable proper other than attaching the draw-bar lug to the turntable girder.

ELECTRICAL SECURITIES.

The Columbus Street Railroad company reports gross earnings for October of $60,617, an increase of $10,486 as compared with the same month of last year, and net $32,540, an increase of $7,307. For the 10 months ended October 31st the gross earnings were $568,982, an increase of $63,728 as compared with the corresponding period of last year, and net $290,833, an increase of $26,087.

MISCELLANEOUS.

Copper deposits have been discovered near Piedmont, Ala., and may possibly be developed.

During the year 1897 there were 822 fires in Pittsburg, and 12 were caused by electricity; that is, about 1½ per cent. of the fires were of electrical origin.

The new Webster street swing bridge in Oakland, Cal., will have a swing span of 348 feet electrically operated. The total length of the bridge will be 992 feet.

The proceedings of the third annual convention of the International Association of Fire and Police Telegraph Superintendents and Municipal Electricians at Elmira, N. Y., last August, have been issued in pamphlet form.

The American Exploration company of Yuma, Ariz., has been incorporated by Philip K. Reynolds and J. H. Carpenter to carry on mining, waterworks, electrical works, street railways and other commercial enterprises. The capital stock is $250,000.

An ingenious method of blowing a steam factory or other whistle at a stated time has been devised by Ellwood Ivins of the Ellwood Ivins Tube company, Oak Lane, Pa. The clock is provided with an index, which may be set at the time at which it is desired to blow the whistle. When the pointers of the clock reach the set time the circuit is closed, and by means of an electromagnet the steam is turned on and the whistle blows.

The Treasury Department has instructed the collector of customs at New York that on the exportation of incandescent electric lamps manufactured by the General Electric company, in part from imported glass bulbs and tubing, a drawback will be allowed equal in amount to the duty paid on such imported materials used in the manufacture, less the legal deduction of one per centum. In the liquidation of entries, 1,000 glass bulbs and five pounds of glass tubing shall be taken as bases of allowance of drawback for each 1,000 lamps exported.

The use of electrical heat in the decoration of pottery is said to be an entire success. Photography is employed to produce the designs and the electric furnace for burning. After the photograph has been applied to the material the photograph is put under a specially prepared glaze and burnt in. A great deal of the beauty and success of the system depends upon the use of the electric furnace, due to the regulation of its high temperatures. It is asserted that the process can be applied to all kinds of ware with commercial success, as it is not costly.

The Engineer of London, alway doubtful of American accomplishment, recently called attention to the announcement of an American contemporary that a train hauled over the Pennsylvania railway, between Altoona and Columbia, consisting of 130 cars, was nearly three-quarters of a mile in length, and weighed 5,330 tons. It was made up as follows: Locomotive, 118 tons; other rolling stock, 1,519 tons; freight (coal), 3,693 tons. The tons were of 2,000 pounds, and the speed was very low. The Engineer added that it would be of interest to know how this enormous train was started. To this the American Machinist replied: "It probably was started by opening the throttle. We usually start them that way."

A centrifugal separator, as used in the separation of cream from milk, is employed successfully at the Bristol corporation electricity works, England, for extracting the oil from condensed water, and when driven by an electric motor the value of the power absorbed is very small. The separator is one of the usual types employed for dairy purposes, and has a Laval steam turbine attached. Its capacity is 400 gallons per hour. When separating 400 gallons per hour the steam consumption is 220 pounds per hour when driven by the steam turbine, and 37.6 pounds per hour when driven by the motor. As the separator when worked by the motor was driven by means of a leather strap and the steam turbine was not disconnected, it is probable that with direct driving the cost of separation can be reduced to below one penny per 1,000 gallons. The separation is so perfect and the power required so small that filtration by centrifugal action is thought worthy of careful attention and further development.

TRADE NEWS.

Gilbert Larue, Fairmount, Ind., is said to be in the market for complete electrical supplies, including 40 street arc lamps of enclosed 220-volt type.

The General Electric company has established a sales office in the Templeton building, Salt Lake City, Utah. It is in charge of Mr. H. E. Chubbuck.

The Fostoria Incandescent Lamp company has opened an eastern office in the White building, 95-97 Liberty street, New York city. This will also be the eastern office of the Crouse-Tremaine Carbon company.

The Leschen-Macomber-Whyte company of Chicago has recently accepted the western agency for the Boston cable hanger, and will carry a full line of these well-known devices in Chicago. The company has also a complete stock of galvanized and copper telephone wire, galvanized steel strand, Crosby clips, etc.

The Western Electrical Supply company of St. Louis, Mo., has received some very large shipments of loricated iron-armored conduit, and is in position to ship the day an order is received. The company reports large sales of the loricated conduit since it took the agency. This company also announces that it has made arrangements with one of the largest and best known foundries in the country to handle gears and pinions and can now furnish them at factory prices. The Western Electrical Supply company solicits correspondence and believes that it can make it an object to managers of electric railways to secure its prices before placing orders elsewhere.

The Montauk Multiphase Cable company of New York is receiving compliments these days. The Scientific Australian tells of a successful test of the Montauk thermostatic cable by the fire department at Melbourne, while at the recent convention of the International Association of Fire Engineers, held in St. Louis, the system was exhibited and commended. The Montauk Multiphase Cable company is making an exhibit of its interior thermostatic electric fire cables at the twentieth triennial exhibition of the Massachusetts Charitable Mechanics' association at Boston. Mr. Lucian W. Jenney, who was in charge of the company's exhibit at the electrical show at Madison Square Garden in May last, has the supervision of the exhibit at Boston.

The Southern Electrical Supply company of St. Louis has moved its store from 14 South Seventh street to a new and spacious building at 507 Market street. A change in the organization has taken place, and hereafter the company will be managed by E. Ruebel, secretary, and Charles E. Sharp, treasurer. Mr. Sharp has been manager of the company for several years and Mr. Ruebel has for many years been president of the St. Louis Electrical Supply company, and during the past few months has been engaged in manufacturing the Ruebel telephones under the name of E. Ruebel & Co. Hereafter these telephones will be manufactured for the Southern Electrical Supply company, which will continue to handle Okonite wire and other supplies.

The Emerson Electric Manufacturing company of St. Louis is making a specialty of the direct connection of electric motors to all classes of light machinery, and is prepared to furnish alternating-current power motors in all sizes from one-thirtieth actual horse power up to three horse power. The company manufactures regularly over 100 different kinds of alternating-current motors alone, and believes it is in a better position to furnish users of alternating-current motors with their exact requirements than any other company in the United States, possibly in the world. All of the products of the factory are thoroughly guaranteed, and if any prospective customer has doubts of the practical working of single-phase alternating-current machinery, the company announces its perfect willingness to send machines to responsible persons on 10 or 30 days' trial, if the user will advise it definitely and in detail just what kind of work he desires the motor to perform. The Emerson company has had a large amount of experience in all classes of small power work, and invites correspondence from either man-

ufacturers, consumers or electrical dealers who have had difficulty in finding the proper electric motor for use on alternating currents. In addition to motors, the company manufactures a complete line of knife switches, switchboards, tablet boards, etc. Catalogues and printed matter describing its product will be furnished to anyone interested on application.

BUSINESS.

Send four cents (in stamps) for an illustrated booklet issued by the Chicago, Milwaukee and St. Paul Railway company, operating the direct route across the American continent to the new transpacific possessions of the United States. The booklet is full of latest reliable information and valuable for reference. It can be used as a textbook in school. Address George H. Heafford, general passenger and ticket agent, Chicago, Ill.

The Western Electrical Supply company of St. Louis, Mo., agent for the Adams-Bagnall arc lamps, reports the new enclosed alternating arc lamp to be a perfect success, fully up to the usual high standard of the Adams-Bagnall lamps.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 8 1898.

613,663. Connector. Frank E. Case, Schenectady, N. Y. Application filed August 5, 1898.

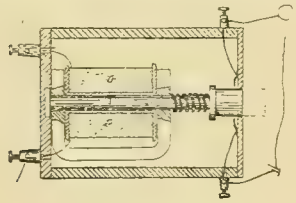
Counterpart terminals have slots registering with screws, and depressions in which the screw-heads may rest to secure the parts together

613,669. Brush Holder. Albert E. Doman, Elbridge, N. Y. Application filed February 4, 1898.

A ball-and-socket joint connects the frame to the brush-clamp, one member of the joint having an aperture, a rod or arm smaller than the aperture being secured to the other member of the joint and projecting through the aperture, and means on the rod are provided for keeping the members in contact.

613,688. Electric Switch. Frederick A. La Roche, New York, N. Y. Application filed December 28, 1897.

The principal parts include a bridge, plates adapted to be connected with one end of a circuit, a pivot carried by the plates and carrying the bridge and provided with a threaded portion, an arm working on the threaded portion and directly connected with the bridge, whereby the arm moves in unison with the bridge, a means of preventing the pivot from turning in the plates, and jaws adapted to receive the bridge and to be connected with the circuit.



NO. 613,778.

613,705. Electric Timing Race Apparatus. John I. McDonald, St. Joseph, Mo. Application filed January 4, 1897.

A race-timing apparatus consists of a dial, a hand cooperating therewith, mechanism for actuating the hand, an electric speed-regulating device for the mechanism, an escapement controlling the speed-regulating device, a standard clock operating the escapement, and means for arresting the motion of the hand-actuating mechanism at will.

613,708. Electric Railway. James F. McLaughlin, Philadelphia, Pa. Application filed May 2, 1896.

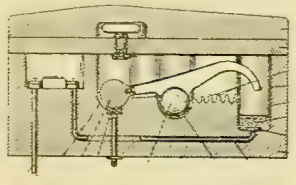
A main conductor and a sectional working conductor, with multiple switches, each arranged to couple a group of successive sections of the working conductor in proper sequence to the main conductor, and means for operating the switches by the passage of a car over the groups of sections controlled by the switches, are described.

613,735. Electric-circuit Controller. Nikola Tesla, New York, N. Y. Application filed April 19, 1898.

Rigid and fluid conductors are adapted to be brought intermittently into contact with each other, thereby making and breaking the electric circuit, and means are provided for imparting rotary motion to both of the conductors.

613,744. Mechanism for Holding Trolleys to Their Wires. William R. Weaver, Covington, Ky. Application filed October 9, 1897.

The combination embraces the pivot-rod and elastic mechanism and means for enabling the holders to cause the arms as they slide in one direction to come together over the wire, or as they slide in a contrary direction to separate and release the wire, at the will of the operator.



NO. 613,794.

613,778. Indicator Signal. Parnell Rabbidge, Sydney, New South Wales. Application filed February 1, 1897.

A permanent magnet is used with a soft-iron armature, that is divided into two parts, one part being attached to one pole of the permanent magnet, while the other part shall be able to slide through or upon the other pole, the outer extremity of the sliding part being formed as an indicator button, which is provided with a metallic flange; an electrical coil surrounds the two parts of the soft-iron armature, and is for the purpose of demagnetizing the soft-iron armature. A spring forces outward the button when the part of the armature to which it is attached is released from magnetic contact with the fixed part of the armature, metallic contact pieces are connected with an electric circuit through a bell or other sonorous signal, which shall be completed when the button is forced outward by the spring and the metallic flange of the button makes contact with the contact pieces.

613,794. Electric Railway. William M. Brown, Johnstown, Pa. Application filed January 22, 1898.

The method of preventing a conductor section from remaining in electrical connection with the high-potential side by means of an arc between the conductor-section and the current-conveying switch consists in breaking the circuit simultaneously between the switch and the conductor-section, and the switch and the terminal of the high-potential side of the circuit, and in providing a short circuit around the arc to the low-potential side of the circuit.

613,809. Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles. Nikola Tesla, New York, N. Y. Application filed July 1, 1898.

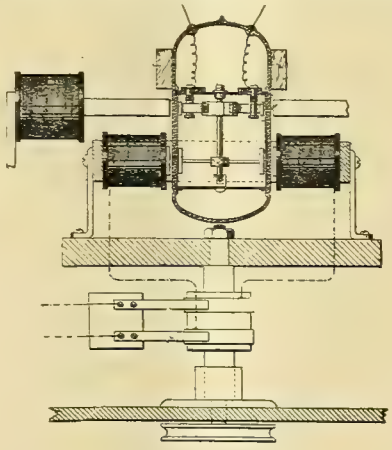
The invention is described as an improvement in the art of controlling the movements and operation of a vessel or vehicle which consists in producing waves or disturbances which are conveyed to the vessel by the natural media, actuating thereby suitable apparatus on the vessel and effecting the control of the propelling engine, the steering and other mechanism by the operation of the apparatus. An important feature of the apparatus is described as a sensitive device comprising a receptacle containing material such as particles of oxidized metal forming a part of the circuit and means for turning the same end for end when the material has been rendered active by the passage through it of an electric discharge.

613,853. Electric Regulator. William H. Chapman, Portland, Me. Application filed March 24, 1898.

Two differentially wound coils are mounted on a tube or cylinder; an iron core is arranged to be moved inside of the cylinder by the magnetic force of the coils, and fitted to act as a piston inside of the cylinder; a passage way leads from one end of the cylinder to the other, and a rheostat is provided whose contact slider is operatively connected to the iron core.

613,864. Phosphorescent Electric Lighting. Daniel M. Moore, Newark, N. J. Application filed December 17, 1896.

The frame, consisting of aluminium plates joined together by rods of aluminium faced with iron, is held in place by portions of the walls of the receptacle forced inward at the sides of the plates, and circuit-interrupting mechanism is mounted in the frame.



NO. 613,864.

613,869. Controlling Device for Electric Motors. Frank J. Russell, New York, N. Y. Application filed May 25, 1898.

The device comprises a pivoted actuating lever, an arm concentrically pivoted therewith and movable independently thereof, a spring between the arm and lever, a locking device for the arm, and circuit connections.

613,875. Marine Governor. John T. Austin, Detroit, Mich. Application filed February 26, 1898.

A series of motors is provided, each adapted to give its valve a determined amount of movement, and electric controlling means for each motor comprising circuit-closing devices arranged at different levels, operated by a change in hydrostatic pressure on the hull at the point adjacent to the screw.

613,880. Generating and Distributing Electric Energy. Charles M. Green, Cleveland, Ohio. Application filed April 18, 1896.

A method of connecting a constant-current dynamo having two or more armature circuits with two or more lamp circuits consists in arranging the connections so that one or more of the armature circuits of the dynamo shall be interposed between the lamp circuits and the voltage kept within safe working limits.

613,881. Generating and Distributing Electric Energy. Charles M. Green, Cleveland, Ohio. Application filed December 23, 1896.

A system of electric generation and distribution consisting in generating electromotive force in two or more sets or groups of armature coils of a closed-coil armature and in distributing the electromotive force so generated in separate external circuits having translating devices included therein, the external circuits being connected between and included in series with the sets or groups of armature coils.

613,882. Generating and Distributing Electric Energy. Charles M. Green, Cleveland, Ohio. Application filed December 23, 1896.

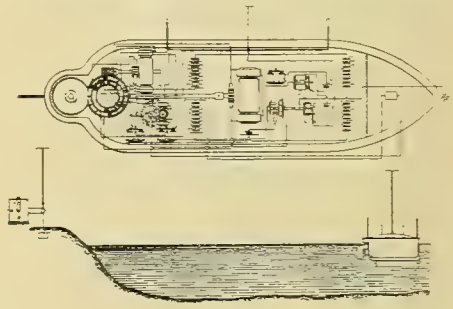
A method of current generation and distribution consists in generating electromotive force in two or more separate armatures operating in fields common to both or all of them, and distributing the electromotive force so generated in separate working circuits having translating devices included therein.

613,894. Dynamo and Electric Motor for Driving Vehicles. John V. Sherrin, Ramsgate, England. Application filed August 17, 1896.

An electric motor comprising a driving-shaft, field-magnets in a frame revoluble therewith, an armature rotating on the shaft, a stationary sleeve between the hub of the field magnet casing and the shaft, the hub rotating on the sleeve and the shaft rotating in the sleeve, and speed-reducing gearing connecting the armature and the field-magnet casing with the shaft, some of the gearing carried by the sleeve.

613,899. Instrument for Measuring Electric Currents. Earl C. Eldredge, Springfield, Mass. Application filed June 20, 1898.

This instrument comprises a case having two binding posts thereon, one in electric connection therewith and one insulated therefrom, each of the posts having a transverse perforation near its outer extremity to receive the end of a wire, and each having a non-removable wire-binding nut thereon.



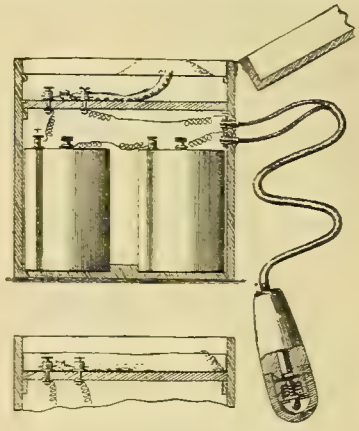
NO. 613,809.

613,918. Electric-lighting System for Vehicles. Rufus N. Chamberlain and Albert S. Hubbard, Belleville, N. J. Application filed February 17, 1898.

The system combines a generator and a lamp circuit, two storage batteries and a switch connecting the generator and lamp circuit interchangeably with the two storage batteries, and another switch and connections controlled thereby, for connecting the two batteries in multiple, while placing both of the batteries in connection with the lamp circuit, but disconnecting them from the generator.

613,955. Flash-light Apparatus. Simon D. Alter and Lewis T. Young, Philadelphia, Pa. Application filed March 12, 1898.

A flashlight apparatus is described in which are combined an electric igniter separated from and free from contact with the mass of flash powder, and a fuse connecting the electric igniting device with the powder.



NO. 613,955.

614,012. Primary Battery. Carl Koenig, Berlin, Germany. Application filed February 16, 1898.

In primary batteries the provision of two or more pairs of alternate concentric elements with insulating pots between each pair and suitable exciting paste between each set of elements, all as a means for obtaining a fairly constant high-voltage current from a cell of small size.

614,025. Brush Holder for Dynamo-electric Machines. George L. Pratt, Atlanta, Ga. Application filed June 2, 1898.

In a dynamo-electric machine, or motor, the combination with the brushes, and electromagnets operating to cause the brushes automatically to engage the commutator, of springs constituting the brush holders, flexed to oppose the action of the electromagnets, and insulated armatures carried by the springs.

Western Electrician.

EVERY SATURDAY.

Vol. XXIII. CHICAGO, NOVEMBER 26, 1898. No. 22

New Chicago Street-lighting Plant.

The plant illustrated by the accompanying picture has just been installed by the city of Chicago at Rice and Lincoln streets to supply current for the street arc lamps in the northern and northwestern districts of the city. All of the electric street lamps in that part of the city are operated from this station, the operation of the old Chicago avenue plant having been discontinued. The nightly load is now 866 arc lamps of 2,000 nominal candle power each, burning, at this season of the year, from 5 p. m. to 6:30 a. m.

As the illustration shows, the plant is an a c-lighting installation pure and simple. It is placed in a building that was erected for a city electric-lighting plant some years ago, but which was used only to a very limited extent, as the money to purchase machinery was not available at that time. Last spring the City Council appropriated $150,000 for electric street-lighting extension, and in May it was decided to equip the station at Rice and Lincoln streets. The plant has been in operation in part for about a month, and the older and smaller Chicago avenue plant, with its less economical machinery, was discontinued last week. The difference in economy was principally effected by the use of comparatively large compound condensing engines and large dynamo units.

Some changes were made in the building, which now consists of a single-story boiler and engine rooms, with provision for coal storage. The building is of brick, and there is a brick partition wall between the two rooms. The floors are of concrete. The stack is also of brick, 100 feet high and octagonal in shape. The only portion of the old equipment retained was four tubular boilers of 100 horse power each and the boiler-feed pumps. These boilers are equipped with Roney automatic stokers. The new boiler-room equipment consists of a 500 horse power water-tube boiler and two 1,000 horse power siphon condensers made by William Baragwanath & Son of Chicago. The new boiler was built by the Aultman & Taylor Machinery company of Mansfield, O., and is hand-fired. Soft coal costing $2.02 a ton is burned, and the feed water is taken from the city mains.

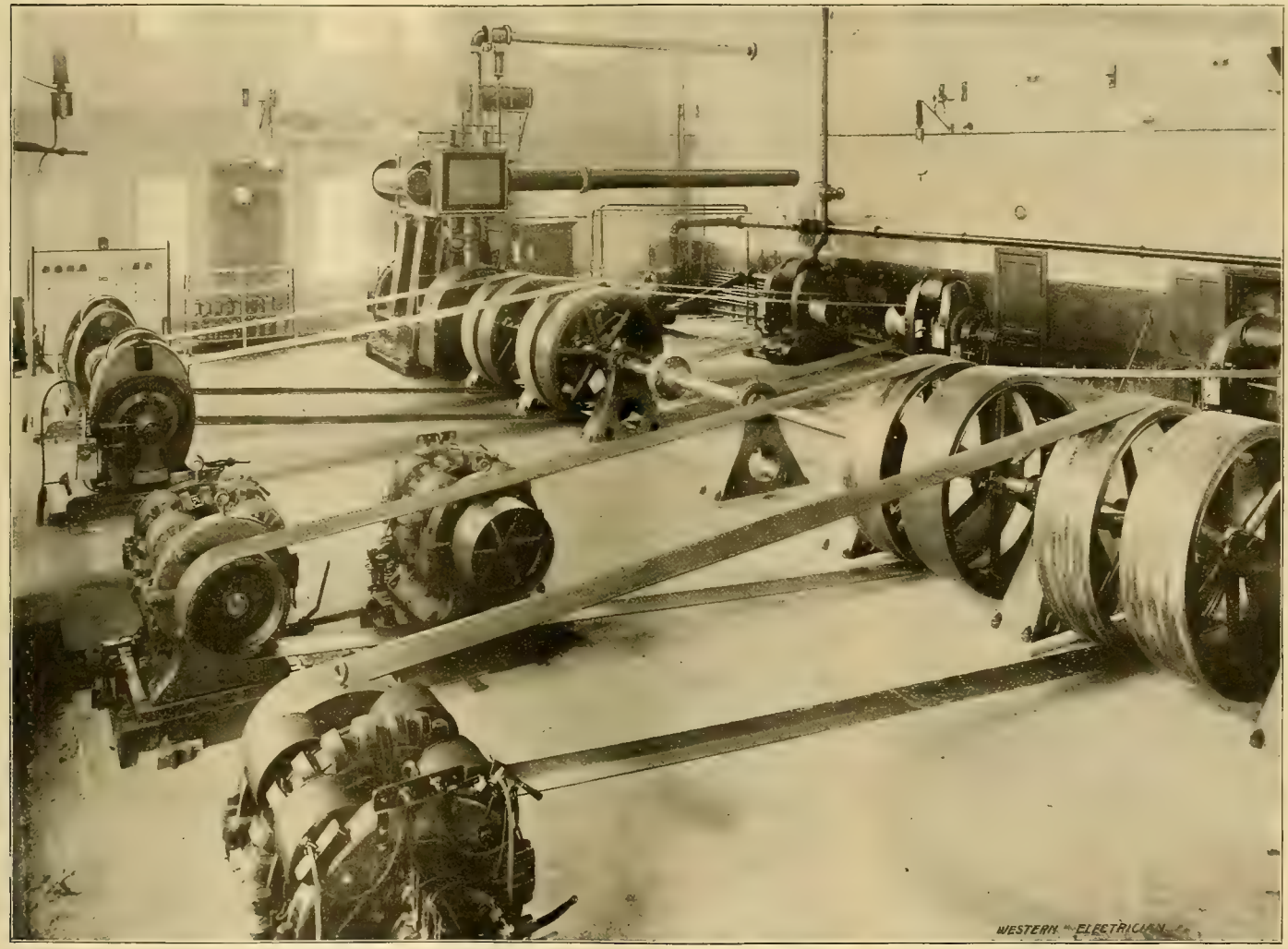
In the engine room, which is illustrated, everything is new. Two vertical compound condensing engines drive directly on a countershaft extending the length of the room, and the dynamos are belted to this shaft on each side. The engines are rated at 600 horse power each and were built at the Charles F. Elmes Engineering Works in Chicago. The shaft is provided with three friction clutches—one at each engine and one in the middle. Thus either engine may drive its adjacent half of the shaft or the whole line.

Eight dynamos were in place when the picture was taken, but another Brush 100-light machine is to be added at once. The fact that the plant was not entirely complete also accounts for the lack of covering on the steam pipes shown. Five of the dynamos are 150-lighters, made by the Western Electric company, and the other three are Brush machines of 100 lights' capacity each. The dynamos are the standard types of the companies named.

The dynamo leads to the switchboard are laid in iron pipe under the floor, and all the outgoing connections from the board are underground. The switchboard is of white marble, with Western Electric instruments and plug switches. It is arranged for 10 dynamos and 10 circuits, to provide for extension.

The new machinery in the plant cost about $37,000, and Mr. E. B. Ellicott, the city electrician, who laid it out, says that the cost of labor for running the station and trimming the lamps is $1,083 a month. The lamps are placed on the regulation side-arm poles adopted by the city and have single carbons 14 inches long and five-eighths inch in diameter. A force of 10 trimmers is employed.

The station is in charge of Daniel B. Dotson, an experienced employe in the electric street-lighting service, who has had the rare experience of receiving a 3,000-volt shock. Mr. Dotson was adjusting the brushes of an arc machine at the old Chicago avenue station when his bare arm accidentally touched the protruding end of a brush strip. His body was grounded through the frame of the machine, and the shock that he received threw him several feet away and apparently killed him. But he was resuscitated after 15 minutes' work and finally recovered, although disabled for seven months. Mr. Dotson bears the scars and still feels the effect of his frightful accident.



NEW CHICAGO STREET-LIGHTING PLANT.

American Electrical Interests at the Paris Exposition.

Upon his return to Chicago from Paris last week, Ferdinand W. Peck, United States commissioner-general to the Paris Exposition, announced the following appointments: Francis E. Drake, Cleveland, director of the Department of Machinery and Electricity; F. J. V. Skiff of the Field Museum, director of the Department of Mines and Metallurgy; John Getz of New York, superintendent of decorations.

Mr. Drake is well known in electrical circles, particularly in the West, and his appointment will be received with favor. His experience should make him familiar with the requirements of American electrical manufacturers. Mr. Drake was associated with the Walker company of Cleveland when he accepted Mr. Peck's invitation to visit Paris in the interest of the American section, but his experience in electrical matters was gained principally through his connection with the Standard Electric company of Chicago.

Grenada Hydro-electric Station.

Two companies since 1893 have participated in the public and private lighting of the city of Grenada in Spain. The small steam plant of the Compania General—one of the companies mentioned—had become insufficient for the demands upon it, and in 1897 the construction of a new power plant was undertaken in the form of a hydraulic installation in a gorge of the Sierra Nevada, at the foot of which flows the Rio Genil. This new source of power is 10 kilometers from the city. The equipment produces a simple alternating current at a difference of potential of 4,200 volts. At present the capacity is 700 horse power, and an addition is now under construction, which will increase it by 350 horse power.

The second company, the Lebon Gas company, has also installed an electrical station, with an output of 600 to 700 horse power, which is operated by steam.

Both systems will soon be merged in one, so that, in case of accident or excessive demand upon one station, the other may contribute temporarily in carrying the load.

Fig. 1. Head of the Water Power.

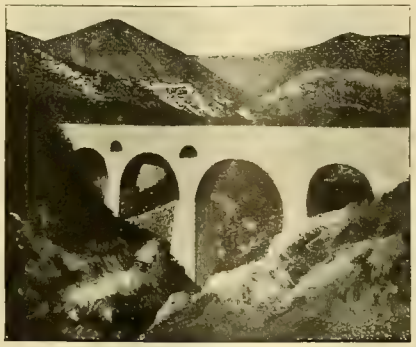


Fig. 2. Aqueduct over Ravin Blanc.

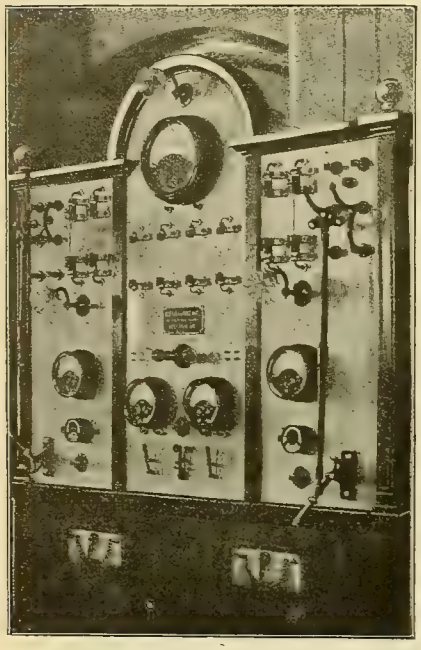


Fig. 5. Switchboard.

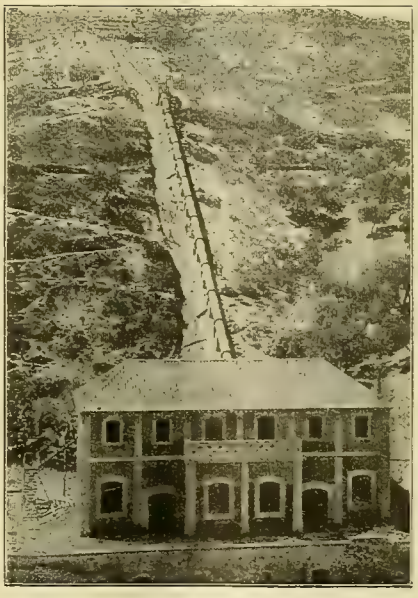


Fig. 3. Station and Conduit.

GRENADA HYDRO-ELECTRIC SYSTEM.

The Rio Genil, which has its rise in the heart of the Sierra Nevada glaciers, has a mean minimum output of two cubic meters per second, with an absolute minimum of 1,400 liters; and upon this last figure the calculations of utilization are based. The output of the stream during freshets, caused by the melting of the snows, is sometimes 10 to 20 times greater.

A dam in masonry, at the head of the waters, closes the gorge, as shown in Fig. 1, and is securely anchored to prevent breaking away. The canal has an air-line length of only about five kilometers, but follows the sinuosities of the gorge. The sharp angles of the route are crossed by 20 tunnels, of which the longest measures 180 meters. At deep valleys and ravines it has been necessary to build a passageway. At the ravine of Anita there are three arches in an aqueduct, 16 meters high; and at Ravin Blanc there is another of four arches, Fig. 2. In several such localities the canal is covered with an arch as a precaution against winter avalanches and summer torrents. The material usually employed is brick and rough stone.

At its lower extremity the canal is open, and enlarged to form a pond of five meters width, whence it flows into the tubular conduit leading to the central station. The station in the valley and the conduit leading down the mountain side are illustrated in Fig. 3. This conduit is built of steel and is 265 meters in length. It is made in two sections, the first of which has a drop of 33 per cent. and the second 63 per cent. The total descent thus formed is 104 meters. This conduit will deliver 700 liters per second, with a speed of one meter per second. Its thickness is from four to 14 millimeters.

The central-station building is arranged for five units of 350 horse power each, but, as will be seen by reference to Fig. 4, only two are now completed. The ground floor is to be occupied entirely by the machinery, and the second will be used for offices, lodging rooms and a small repair shop.

The water connections for the five turbines are in the rear of the building, and are controlled from the machinery room by an endless-screw combination.

The turbines give an effective power at the shaft of 340 horse power at 350 revolutions per minute. The discharge in liters per second is 340.

Turbines and dynamos are direct-connected through an insulating coupling. The flywheel weighs 2,600 kilogrammes. The periphery of this huge balance has a speed of 30 meters per second.

The alternating dynamos have fixed armatures and deliver 54 amperes of current at 4,200 volts. Automatic oilers provide proper lubrication. The 18 polar pieces radiating from the center are made of laminated iron and paper, and the bobbins are made up of 87 meters of 3.5 millimeters of copper with an insulation of one-half a millimeter, the rest of the construction being of the regulation form. The exciter coils comprise 525 turns of copper of 4.5 millimeters, and one millimeter of insulation—the length of wire being two kilometers, with a resistance of two ohms. The air space between the pole-pieces and the armature is eight millimeters. The periphery, at 350 revolutions, travels over 30 meters per second, the periodicity being 52.5 per second, giving 6,300 alternations per minute. The machines are insulated from ground by porcelain blocks, on which they rest. Additional protection is afforded employes by a plank platform, which surrounds the machines and which also rests on porcelain.

The switchboard (Fig. 5) is of marble, and contains the usual appliances. The station transformer has a regulator for keeping the secondary current constant, as has also the voltmeter transformer, the latter being automatic. Two automatic lightning arresters carry objectionable currents to ground. These instruments are actuated by self-induction, and they are especially essential in that locality, owing to the fact that every evening, at sundown, there are heavy discharges of atmospheric electricity on the high-tension line.

The line carrying alternate current at 4,200 volts is composed of two conductors of eight millimeters diameter, capable of handling 350 horse power a distance of 10 kilometers with a drop of eight per cent., or 700 horse power with 16 per cent. loss. A second similar line is to be installed on the same posts, which, by the way, are of fir. They are brought from Cuenca, and are set from 1½ to 2½ meters in the ground, a necessary precaution, because of the poor consistency of the soil. The lower portion of the post is first charred and then tarred. The dryness of the atmosphere tends to the preservation of the posts.

The high-tension wires are of eight millimeters diameter, on triple-petticoat insulators with green bell-top, and are at least 8.50 meters above the earth. The same posts carry a metallic telephone circuit seven meters from the ground. These conductors are of steel, two millimeters in diameter, and are only crossed at one point on the route, this having been found sufficient to overcome the effects of self-induction.

Before entering the city the copper line is insulated with a wrap of cotton, a layer of guttapercha, with a tape of rubber cloth, and vulcanized. There are 10 branches from the main line, feeding as many transformers, nine of which are located in special metallic kiosks, and one in the loft of a sugar refinery outside the city. Iron brackets of gas-pipe support the insulators for the entire high-tension line.

Two transformers—one at the Alhambra in an Arabic tower especially erected for it, and the other at the University Institute of Sacramento—have iron cores and closed magnetic fields. Circuit breakers for high and low tension protect them, and an attached lamp permits of their inspection, while a three-way switch will throw out the secondary entirely.

Several motors have been installed in paper mills, beet-sugar mills, alimentary and textile establishments and in cafés, printing establishments, stores, etc., for ventilation, as well as for elevators.

The prices charged are as follows: Lamps of five, 10, 16, 25 and 52 candle power, each 24, 36, 54, 84 and 107 pesetas respectively, or, by meter, one peseta per kilowatt-hour. Experiments show that of 5,000 10 candle power lamps—which is the usual standard there, as 16 is in the United States—not more than 3,375 are in use, on an average, at the same time. These figures have been repeatedly verified. The cuts are reproduced from l'Industrie Electrique.

Tesla Demands an Apology.

Nikola Tesla has a grievance. He resents the imputation that he is a humbug, and proclaims himself a "Christian and philosopher," citing in support of this assertion the fact that numerous offenses against his dignity and personal wishes have been committed by those who have posed as his friends, but that in every case he has forgiven them freely. In further proof of his forbearance he declares his willingness to extend pardon for the last offense and restore the erring ones to favor, conditioned, however, upon the publication of a "complete and humble apology." Mr. Tesla has furnished the Western Electrician the following copy of a letter upon this subject which is self-explanatory:

To the Editor of the Electrical Engineer:

By publishing in your columns of November 17th my recent contribution to the Electro-therapeutic society you have finally succeeded—after many vain attempts made during a number of years—in causing me a serious injury. It has cost me great pains to write that paper and I have expected to see it appear among other dignified contributions of its kind, and, I confess, the wound is deep. But you will have no opportunity for inflicting a similar one, as I propose to take better care of my papers in the future. In what manner you have secured this one in advance of other electrical periodicals who had an equal right to the same rests with the secretary of the society to explain.

Your editorial comment would not concern me in the least were it not my duty to take note of it. On more than one occasion you have offended me, but in my qualities both as Christian and philosopher I have always forgiven you and have only pitied you for your errors. This time, though, your offense is graver than the previous ones, for you have dared to cast a shadow on my honor.

No doubt you must have in your possession, from the illustrious men whom you quote, tangible proofs in support of your statement reflecting on my honesty. Being a bearer of great honors from a number of American universities, it is my duty, in view of the slur thus cast upon them, to exact from you that in your next issue you produce these, together with this letter, which, injustice to myself, I am forwarding to other electrical journals. In the absence of such proofs, which would put me in the position to seek redress elsewhere, I require that, together with the preceding, you publish instead a complete and humble apology for your insulting remark, which reflects on me as well as on those who honor me.

On this condition I will again forgive you, but I would advise you to limit yourself in your future attacks to statements for which you are not liable to be punished by law.

New York, November 18, 1898. N. TESLA.

Telegraphs in Cuba.

The Signal Service Corps has begun the construction of a government telegraph line connecting Santiago with Manzanillo. The construction party comprises 35 officers and men and a medical officer. They carry provisions for two months. The wire will be stretched overhead along the road over which the Spanish general, Escario, marched his 3,500 men 170 miles from Manzanillo in 10 days to the assistance of General Toral, when the Americans were before Santiago early in July. The line to Guantanamo is almost finished, and will soon be in use. General Wood has ordered Captain Brady of the Signal Service Corps to begin the construction of a line to Holguin and Gibara immediately, in order that headquarters of the department may be in touch with Colonel Hood's Second Immunes, who are stationed at Gibara, with which place there is now no communication except by coasting vessels.

Practical Points on Electrical Measurement.[1]

By W. B. Hale.

Since most commercial types of ammeters and voltmeters are direct-reading, their use is readily understood by any one. A few suggestions may not, however, be out of place. Most especially do I wish to remind you that voltmeters and ammeters are essentially alike in construction and operation, and that an instrument which in one case indicates volts may in another indicate amperes, and vice versa. An ammeter is a low-resistance voltmeter, and a voltmeter is a high-resistance ammeter. A disregard of this simple truth has led to more errors in the use of these instruments than all other causes combined.

To make this plain to you, I shall assume that we have a battery of 50 storage cells whose voltage we wish to measure, and that for this purpose we have a Weston voltmeter reading from 0 to 150 volts. The internal resistance of the cells is so low that we may disregard it entirely, and may consider the battery merely as a source of electromotive force. We connect the voltmeter to the battery terminals and find that it reads 100 volts.

Now, let us assume that we have a means of gradually increasing the internal resistance of these cells without affecting their electromotive force. Suppose, for example, that we slowly siphon off the electrolyte and refill the jars with distilled water, and, as we do so, watch the voltmeter needle. Does it still point to 100 on the scale? No; it is gradually dropping back. At one time it may indicate, say,

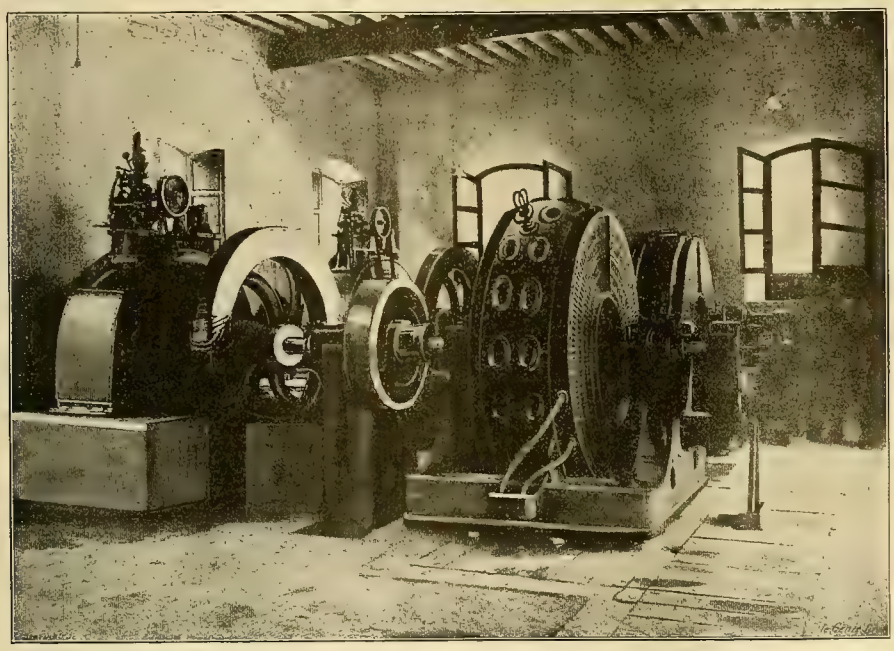


FIG. 4. GRENADA HYDRO-ELECTRIC STATION.—INTERIOR OF POWER PLANT.

50 volts. "Is 50 volts, then, the difference of potential at the battery terminals?" you may ask. Not at all; it remains 100 volts as before, as an electrostatic voltmeter would show. If that is the case, why does not the voltmeter mark the correct voltage? Because we are now using it as a milliammeter instead of a voltmeter.

Let me make this clear to you. The resistance of Weston voltmeters averages about 120 ohms to the volt. Consequently our 150-volt instrument has a resistance of about 18,000 ohms, and the current flowing through its coils with one volt pressure is 1-18,000th of an ampere. In other words, it is a galvanometer which has been calibrated to give a deflection of one scale division with 1-18,000th of an ampere. If we raise the voltage to 100, the current in the voltmeter rises to 1-180th ampere and deflects the needle 100 scale divisions.

We now see why the voltmeter needle dropped back as we increased the internal resistance of the battery, for when this resistance had risen to, say, 18,000 ohms, the maximum current the battery could send through its own resistance plus that of the voltmeter was 1-360th of an ampere—just enough, in fact, to deflect the needle 50 scale divisions, which is apparently 50 volts.

If anyone is inclined to doubt this statement, let him take a 100-cell silver-chloride dry battery and measure its electromotive force with a Weston double-scale portable voltmeter, range 0-750 and 0-150 volts, respectively. He will find the reading on the 750-volt scale to be five or six volts higher than the reading on the 150-volt scale. This discrepancy is due to the comparatively high internal resistance of the battery. It is sometimes explained by saying that there is a greater "drop" through the lower resistance coil of the voltmeter under these circumstances. While such a statement is correct, I should not recommend you to employ it, as it leads to a misconception of the term "voltmeter." Whenever the conditions are such that you have a noticeable fall of potential through your voltmeter, I would advise you to look upon it as a current indicator—a milliammeter—which, for the time being, it certainly is. This assumption will simplify your work and help you to avoid many errors. If the Weston voltmeter scales were marked so as to read in milliamperes as well as volts, it would be a decided advantage.

Let us now consider the practical use of these instruments in general testing.

No doubt you have all read in the technical journals, at different times, articles describing methods of measuring insulation resistance, etc., with a Weston portable voltmeter; and you must have noticed that, in the majority of cases, they are a maze of symbols and formulas, in which V's, R's and A's play a prominent part, with here and there a sprinkling of X's and Y's to give the mixture a sprinkand flavor!

Now, while this is no doubt very scientific, is it not somewhat out of place in methods designed for everyday use? Have we not all had a formula slip our memory just when we needed it most? And have we not then sacrificed valuable time in looking it up? Well, in a great many cases, the formula is as unnecessary as it is hard to remember. Let us see if we cannot solve many problems in electrical measurement without it.

Measurement of Resistance.—General Method.

Connect the unknown resistance in series with a known resistance and a source of electromotive force, such as a battery or a generator. Then with a voltmeter of suitable range note the readings—first, when it is applied to the terminals of the known resistance, and second, when it is applied to the terminals of the unknown resistance. It is evident that these voltages will bear the same relation as the resistance at whose terminals they exist. If, for example, the known resistance is 1,000 ohms, and the voltmeter readings are 64 and 46 volts respectively, then the unknown resistance is

$$\frac{1{,}000 \times 46}{64} = 718.75 \text{ ohms.}$$

Measurement of Low Resistances.

Pass through the resistance the largest current it will carry without heating, and measure the difference of potential at the terminals with a millivoltmeter. Then, C and E being known, Ohm's law gives us

$$R = \frac{E}{C}.$$

This method is applicable in many cases where the Wheatstone bridge would not give satisfactory results. It is especially useful in locating crossed, open or grounded coils in armatures; also, in measuring variable resistances, such as poor contacts in switches, cut-outs, etc.

Measurement of High Resistances.

I have here a Weston voltmeter reading to 150 volts. Its internal resistance is 19,600 ohms. I connect its binding-posts to the incandescent system and the needle deflects 110 divisions, indicating 110 volts pressure. I then open one side of the circuit and insert a high-resistance coil. The voltmeter needle now points to 35 on the scale. Can we find out from this the number of ohms in the rheostat without using a formula? Yes; more easily without it than with it. For instance: We saw that 110 volts sent sufficient current through the resistance of the voltmeter (19,600 ohms) to deflect the needle 110 divisions. In other words, with 110 volts pressure

110 divisions deflection indicates ... 19,600 ohms total resistance
1 " " " 19,600 ÷ 110 = 2,156 ohms
35 " " " 2,156(.66) 5 = 61,600 "

This gives us the total resistance in circuit, and subtracting the resistance of the voltmeter, we have as the value of the rheostat 61,600 — 19,600 = 42,000 ohms.

Following is the rule: Multiply the number of ohms in your voltmeter by the number of volts you are working with. This gives the "constant" for that voltage. Then note the voltmeter reading when the unknown resistance is added to the voltmeter circuit. Divide your constant by this reading, and the result, minus the resistance of the voltmeter, is the number of ohms in the unknown high resistance.

Measurement of Insulation Resistance.

In insulation-resistance work the voltmeter resistance may usually be disregarded, it being insignificant in comparison with the very high resistance we are measuring. The operation is then extremely simple. To find the insulation resistance of an electric-light main, for example, ground one binding-post of the voltmeter and connect the other to the main that is clear. Divide the scale-reading thus obtained into your constant, and you have directly the insulation resistance in ohms of the faulty main.

If both mains have leakage to ground the foregoing test should be made on each side of the circuit. Then the voltmeter constant divided by the sum of the two readings will give the insulation resistance of the entire system. A formula is by some considered indispensable in this test. Would they use a formula to calculate the current flowing through a divided circuit, or would they insert ammeters into the several branches and add the ampere readings? This last is practically what we have done here. When the voltmeter is connected between the positive main and the ground it indicates by its deflection the number of milliamperes of current leaking through the insulation of the negative main to ground, and when it is connected between the negative main and ground it indicates, in a like manner, the leakage from the positive main. It is evident that the sum of these readings gives us the total current that would flow through the insulation of both mains were they to be connected to one pole of the generator, with its other pole grounded.

If you wish to measure the insulation resistance of a system of incandescent wiring, disconnect the system from, say, the positive main where it enters the building, and ground that main through a lamp; then insert the voltmeter between the negative main and the entire installation. This is most conveniently done at the main cut-out, where you may remove the fuses and connect one binding-post of the voltmeter to both sides of the house circuit looped together, and the other binding-post to the negative main. Then ground the positive main through a lamp or fuse, and note the voltmeter reading. Divide this reading into the voltmeter "constant" for the voltage of the system, and you have the insulation resistance of the plant.

Battery Testing.

A Weston portable voltmeter with a three-volt scale is excellent for tests on individual cells. Unless the battery has an abnormally high internal resistance, the voltmeter reading will represent its true electromotive force.

Internal Resistance of Cells.

We have here an ordinary Leclanche porous-cup battery. The voltmeter shows that its electromotive force is 1.55 volts. I close the cell through 10 ohms external resistance, and the voltmeter now indicates 1.43 volts as the difference of potential at the terminals. Now, the electromotive force of the battery is probably generated where the chemical action is taking place; that is, at the surface of the zinc element; and when we put the cell on a closed circuit there is a fall of potential through both the external and internal resistances. We have, in fact, a current flowing through two resistances in series, and, as we have seen in our previous tests, the potential differences at their terminals are proportional to the resistances themselves.

Well, we have just found that the electromotive force of this cell is 1.55 volts, and that its potential when closed through 10 ohms is 1.43 volts. The difference between these values, which is .12 of a volt, must represent the fall of potential through the internal resistance of the battery. Or, to put it in the form of an equation:

1.43 : .12 :: 10 ohms : internal resistance of cell.

Therefore, internal resistance = (.12 × 10) ÷ 1.43 = .84 ohm.

There are more exact means of determining the internal resistance of batteries, but this method is sufficiently accurate for all practical purposes.

Suggestions.

The excellence of the Weston portable instruments and their widespread use justify, I think, the time we have devoted to their consideration this evening. In the Weston voltmeter, in particular, we have a portable and sensitive D'Arsonval galvanometer of great usefulness. Before concluding, I should like to read you a short list of "Don'ts," made up from practical experience.

1. Read before the Chicago Electrical association, October 21, 1898.

(1) Don't place the voltmeter near dynamos or motors, nor close to any large mass of iron.

(2) Don't set it down roughly, and, above all, don't get into the habit of tapping the case every time you take a reading. If the needle sticks, the voltmeter needs to be repaired.

(3) Don't connect the three-volt coil to 110-volt mains. It would be better if the left-hand binding-post of the lower scale had its value stamped in more conspicuous figures, as the small figures now used are often hardly distinguishable after the binding-post has been handled for any length of time.

(4) Don't screw the portable voltmeters to your switchboard or to the wall and expect to get good results; they should always be placed on a level surface when used.

Finally, Do mark the resistance of your voltmeter and its "constants" for standard commercial voltages on a small card, and attach this to the instrument; you will find it useful. (If the manufacturers of the Weston voltmeter would stamp the resistance of its coils on the instrument itself, it would be a

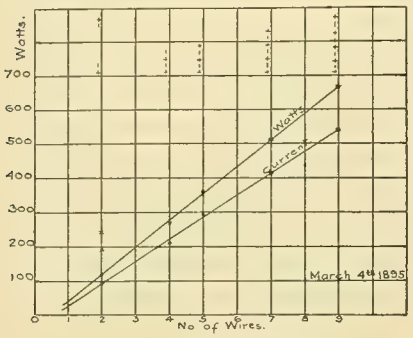


FIG. 2. HIGH-VOLTAGE POWER TRANSMISSION.

great convenience. They now mark the resistance only on the lid of the carrying case, and as these lids are frequently broken, lost, mislaid or interchanged, it is often difficult to find out the resistance of the voltmeter one is using.)

I will close this paper with a few words on practical units of measurement.

We have here a simple circuit of one-ohm resistance carrying one ampere of current.

The difference of potential at its terminals is, of course, one volt.

One coulomb of electricity will pass any point in this circuit in one second of time, and will charge in one second a condenser of one farad capacity to a potential of one volt.

Power will be developed in this circuit at the rate of one watt per second, and the work done in one second will be one joule.

If the current in this circuit commence at zero and rise to maximum in one second, and if during that time it encounter an opposing electromotive force equivalent to one volt, then the inductance of the circuit is one henry.

High-voltage Power Transmission.[1]

By Chas. F. Scott.

Part I.

Several years ago an investigation of the conditions and requirements incident to the use of high voltages was undertaken by the engineering department of the Westinghouse Electric and Manufacturing company. In this experimental investigation the size of the apparatus and the conditions of the tests were as far as practicable such as would prevail in actual work.

The transformer, the sine qua non of high-voltage working, receiving first consideration. A design suitable for large sizes was worked out and tested; then high-voltage windings were made. Attention was next directed to the line insulator.

New phenomena were liable to be presented at higher voltages and it was necessary to determine what they were, also how to meet the requirements which they impose. New forms and sizes of insulators were designed, made and tested to determine the losses which would occur and the limit at which they would break down.

The luminosity and the hissing sound emitted by the connecting wires of high voltage suggested a loss which might be an appreciable addition to that over the surface of the insulators. It was found that a very considerable loss of energy took place between the wires—a loss which at high voltages was much in excess of that across the surface of the insulators.

Mr. L. L. Nunn visited Pittsburg at this time and became much interested in this work. He was a pioneer in power transmission, having put in the first large alternating-current transmission plant in this country, namely, that at Telluride, Colo., which was designed by the writer and described by him[2] at the general meeting of this Institute in 1892. It was proposed that this work be taken up conjointly by the Westinghouse company and Mr. Nunn, and prosecuted on a much enlarged scale, by operating the original motor over a high-voltage line. In a report to the vice-president and general manager of the electric company, dated April 2, 1895, the writer said: "The transformers would be arranged to give a line pressure of 10,000, which is to be increased by suitable steps to possibly 50,000 volts. . . . I regard this as an excellent opportunity to make a thorough and extremely important and valuable test of high-tension working under difficult practical conditions, which our company should take up and carry out as fully as possible." Raising and lowering transformers were made and sent to Telluride, and power for the 100 horse power synchronous motor was transmitted at voltages far exceeding any which had been previously used anywhere. Exceptional facilities were afforded for observing the practical operation of high-tension working under severe climatic conditions, and for making measurements. The results of the work were so assuring that the Telluride Power Transmission company has lately installed a plant which is in commercial operation at 40,000 volts, and is now making an increase in the plant. This work has been continued on experimental circuits at East Pittsburg, and some measurements have been made at Niagara.

The work which has just been briefly described was an investigation into an unknown field. It has been progressively and systematically carried out, and it has determined results which were unforeseen, and which are of both theoretical interest and practical importance.

This present paper describes the more interesting and important parts of this work and gives the methods by which measurements have been made and the results which have been reached. A number of points of interest and importance are given with regard to long-distance transmission plants now in operation.

High-tension Transformers.

In 1891 the Westinghouse company furnished transformers for the 10,000-volt transmission to San Bernardino and Pomona. Twenty transformers were used in a set, each giving a pressure of 500 volts and the 20 in series 10,000 volts. This arrangement made the insulation within the individual coils a matter of comparative ease. The insulation between the coils of the high-tension circuit and other parts of the transformer was secured by allowing a space, which was filled with oil.

The first arrangement of transformers for giving from 30,000 to 50,000 volts was made by using a

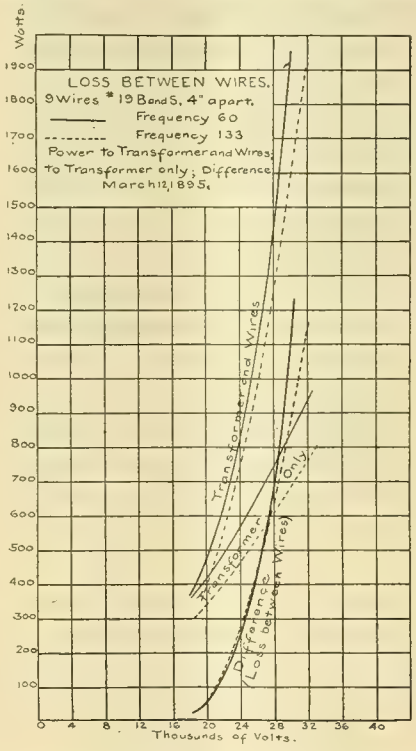


FIG. 1. HIGH-VOLTAGE POWER TRANSMISSION.

number of transformers, each giving 10,000 or 15,000 volts. The low-tension circuits of the several transformers received current from an insulating transformer in which there were a number of separate coils, each one supplying a separate raising transformer. An arrangement of this kind was used for obtaining the high voltages in the exhibit of the Westinghouse company at the World's Fair. A large transformer was designed in January, 1894. The output of 200 kilowatts was many times greater than that of any transformers which had been made by the Westinghouse company. The transformer was oil-insulated and was cooled by water flowing through a pipe immersed in the oil. This transformer was pronounced a success, and the type was adopted and has been followed ever since as a standard, except that the water cooling is employed only on the largest sizes.

The transformer was then rewound for 40,000 volts and a somewhat reduced output. It was operated at this voltage for a short time, when it was found that, through an oversight, the insulation between layers was insufficient. In October the high-tension coils were rewound for 60,000 volts and the transformer is still in use after many months of varied service and a considerable period of inactivity.

The making of a single large transformer for a very high voltage naturally involved new difficulties. Above 10,000 or 20,000 volts there was an unexplored and uncertain field in the matter of insulation. Materials which were commonly used at ordinary voltages might have very different characteristics under the new conditions. Tests were made on materials before the first high-voltage transformers were made, and it has been continued. The large high-tension transformer as made to-day was not designed in a week or a month, but it has been an evolution based upon experimental tests and experience in continued operation.

High-tension Insulators.

After a high-voltage transformer was constructed, the insulator naturally presented itself as a fundamental factor in transmission. The requisites of an insulator for high-voltage work are that it shall

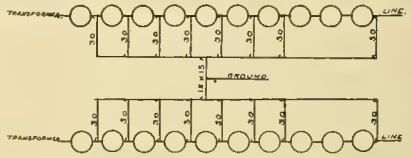


FIG. 3. HIGH-VOLTAGE POWER TRANSMISSION.

have a dielectric strength sufficient to prevent the current passing directly through the material, that its dimensions shall be large enough to prevent the passage of current over the outside of the insulator to its support, and that the resistance, both of the material and its surface, shall be sufficiently high to prevent undue loss of energy. In addition to these fundamental electrical requirements are those of a mechanical nature involving strength and convenience. These properties must, of course, be permanent, and not liable to deterioration while in service.

Up to this time very little attention had been given to the manufacture and design of high-tension insulators. There were available for our laboratory tests the glass insulators which we had designed for the 10,000-volt transmission line at San Bernardino and Pomona, Cal. (See paper of Mr. G. H. Winslow[1] before the general meeting of the Institute in 1895.)

A much larger glass insulator was made having the so-called "helmet" form, which was probably the beginning of a type which is now quite common. The large glass insulator presented mechanical difficulties in manufacture, and recourse was had to porcelain. An insulator was designed to be underhung, the top of the insulator being supported in an inverted cup, which was to be bolted to the under side of the cross-arm. From the bottom of the insulator a pin extended which was anchored in a hole in the insulator and held the wire several inches below the porcelain. The object was to place the wire below the cross-arm, so that the snow which might pile up on the cross-arm would not come near the insulator. The wire, moreover, instead of being supported upon the top of the insulator, where it is in connection with an extended wet surface, would be supported from the part of the insulator which is most protected and the dryest.

An interesting evolution then began to take place in the manufacture of porcelain. There were eight or 10 steps in this history, in which insulators which were presumed by the manufacturer to be satisfactory were broken down on high-voltage test. Porcelain which presented a beautiful smooth glazed surface was often found to contain internal cracks or cavities which were soon traversed by the current. In other cases bits of pebbles or other impurities were found. In still other cases the porcelain was not homogeneous and was not compact, or the material was porous and absorbed a drop of ink almost as readily as a lump of sugar would do. The effect of this work is seen in the improved quality of material now made by certain porcelain manufacturers who benefited by this experience. It may also be remarked that some of the unpleasant experiences with porcelain insulators might have been prevented if similar preliminary tests had been made instead of employing the more expensive and inconvenient method of testing them in commercial service.

The under-hung form of porcelain insulator, however, did not prove successful or satisfactory. The insulator was heavy and cumbersome, and no satisfactory method was devised for holding the wire. A wooden pin lacks strength and a metal pin reduces insulation. Moreover, smaller insulators of the ordinary form were found suitable for higher pressures than was anticipated.

Some measurements were made of the losses on the Pomona insulators. Twenty-four insulators were mounted on wooden pins. A wire was run along the tops of the insulators and a second wire connected the pins. The increase produced in the reading of a wattmeter in the primary of the raising transformer when the wires were connected to the high-voltage terminals was taken as the loss on the insulators. The loss at 25 000 volts was about two

1. American Institute of Electrical Engineers, general meeting, Omaha.

2. Transactions, Vol. ix., p. 425.

1. Transactions, Vol. xii., p. 405.

watts per insulator. This voltage between pin and wire corresponds to 50,000 volts between transmission wires.

Losses Between Wires.

The loss over the surface of insulators was quite small, in fact almost insignificant, compared with the amount of power which would ordinarily be transmitted. The various displays of energy about high-tension wires led us to investigate and determine whether this loss was one of importance. In order to measure the loss between wires, eliminating what occurs on the insulators, it was desirable to have a considerable length of wire, to support it without insulators, and preferably to arrange the wires in such a form as to give a considerable loss. Nine wires each 60 feet long were stretched four inches apart in a horizontal plane and were held in place by strings several feet in length at each end. The wires were No. 19 B. and S. gauge, 0.036 inch in diameter. They could be connected in various ways, and any pair or pairs of wires could be omitted as desired.

The power supplied to the raising transformer was measured by a wattmeter placed in the primary low-tension circuit. When the load was placed on the transformer, the wattmeter reading increased, and the amount of increase was taken as the power delivered to the load. This method involves certain errors, which will be pointed out further on, but, on the whole, it gives an approximate and fairly correct indication of the power, and is sufficient to show clearly the general form of the loss curves and a number of interesting characteristics.

The first measurements of this loss are recorded February 26, 1895. The first, third, fifth, seventh

FIG. 4. HIGH-VOLTAGE POWER TRANSMISSION.—50,000 VOLTS ON LARGE GLASS INSULATORS ON TOP CROSS-ARM AND PORCELAIN INSULATORS ON LOWER CROSS-ARM.

and ninth wires were connected in multiple to one terminal, and the other wires were connected to the second terminal of the raising transformer; successively increasing voltages were applied.

The wires began to give a hissing or crackling sound, and in the dark began to appear luminous at a little below 20,000 volts. As the voltage was increased the sound became more and more intense, the wires vibrated and became more and more luminous, until, at the higher voltages, they were surrounded by a coating of soft blue light many times the diameter of the wire. Often there were bright points along the wire, probably corresponding to bits of dust or rough places resembling points on the wire. The large room soon became strongly charged with ozone.

Results of measurements on all wires, alternate wires being connected together to one terminal, and the intermediate wires to the other terminal of the raising transformer, are given in the accompanying Fig. 1. Three curves are given for a frequency of 60 periods per second, or 7,200 alternations per minute. Two of these curves give the wattmeter readings for the different voltages, one for the transformer alone, and the other for the transformer and high-tension wires. The third curve gives the difference between the two, and therefore represents approximately the loss on the high-tension wires. Corresponding curves are given of tests made at a frequency of 133. The loss in the transformer is less at the higher frequency, but the loss on the high-tension wires is almost the same for both frequencies. These losses are very small below 18,000 volts, but increase rapidly up to 30,000 volts, which is about the highest pressure used.

As the two sets of tests were made with dynamos having different characteristics, they may not accurately represent the relative effects of the frequencies. The difference due to causes other than the frequency are, however, probably small, so that these tests are correct in showing the general relation between the loss and the pressure, and in indicating that the loss depends little, if at all, upon the frequency.

Tests were made with different numbers of wires. In one case the measurements were made with the arrangement described above, in which five wires were connected together and the four intermediate wires were connected to the second terminal of the raising transformer. Two wires at one end were then left off. Two of these were next omitted, leaving three connected to one terminal and two to the other. One of these was left off, leaving the first and third wires connected together, and the second and fourth also. The first and ninth wires were then connected together, also the second and eighth. As the first and second wires were well separated from the eighth and ninth, the mutual effect between them is negligible, so that the loss in this case may be considered as double that which would be obtained from the first and second wires alone. The results of this measurement are plotted in Fig. 2. The points for both loss and current fall on a straight line and indicate that each additional wire causes a definite increase.

Measurements made upon wires at greater distances show that the action is considerably less as the wires are separated. The loss is approximately the same at 28,000 volts when the wires are four inches apart that it is at 36,000 volts when they are 16 inches apart. The loss for a distance of eight inches is intermediate.

Other measurements were made, but nothing of further importance was developed. It is interesting to note that within a few days of the first measurements the general characteristics of this loss were determined, namely, that the loss between wires increases rapidly after a critical voltage is reached, that the loss is practically independent of the frequency, that it is much less as the distance between wires is increased. When a loss of 1,200 watts was obtained on a total length of 540 feet of wire at only 30,000 volts, the important bearing of this phenomenon upon transmission became very evident. The tests were stopped as preparations were begun for the continuation of the work at Telluride.

Transformers at Telluride

The original Telluride plants operated at 3,000 volts. Both the generator and the synchronous motor were wound for this pressure. Two transformers were furnished for the high-voltage tests, one for raising the generator voltage for transmission and the other for lowering the voltage for the motor. The windings were connected with a number of terminals by which the high-tension voltage could be varied over a wide range up to 60,000 volts.

Coils of similar shape were placed side by side in what is known as the "parallel" form of construction. Each coil had many layers of wire and but few turns per layer, thus securing a small difference of pressure between consecutive layers. The high-tension winding was divided into four similar coils, each designed to give a maximum of 15,000 volts. The individual coils could be differently connected, either in series or in multiple. The low-tension coils were five in number and were provided with loops, by which the number of effective turns could be varied. Three low-tension coils were placed between two pairs of high-tension coils and the two remaining low-tension coils were placed on the two ends. Between the low-tension and high-tension coils metallic shields were placed, which were connected to the ground for protecting the low-tension circuit from danger in case of accidental contact with the high-tension circuit, and also for screening the low-tension circuit from electrostatic induction from the high-tension windings. The transformer was immersed in a case containing oil. The iron and the case of the transformer, as well as the shields between the coils, were connected to the ground.

There was also an auxiliary transformer, whose primary was connected across the generator terminals, while its secondary was placed in series with the circuit to the raising transformer, thus either raising or lowering the generator electromotive force, as desired. The secondary had a number of steps, so that the voltage could be varied at will.

The Transmission Line.

The line extends from the power station near Ames, which is a few miles from Telluride, Colo., to the Gold King mill. The line passes over an exceedingly rugged country, and has a total length of nearly 2¼ miles (11,720 feet). There are 62 poles, each carrying three cross-arms, the upper being about 26 feet from the ground. Each cross-arm carries two wires supported by insulators, which are designated as follows: Large glass, small glass, porcelain. (See Figs. 4 and 5.) The large glass insulator is the same as that used on the circuit in the San Bernardino and Pomona plant. The total height is five inches and the maximum diameter 5½ inches. The bottom of the insulator stands 1¼ inches above the cross-arm. The porcelain insulator is 4 1-16 inches high and 5⅞ inches in diameter. The bottom is 3 1-16 inches above the cross-arm. The small glass insulator is 3½ inches in height, 4¼ inches in diameter and stands 2¼ inches above the cross-arm. The insulator is triple-petticoat; the other two insulators are double-petticoat. The circuits were strung with galvanized iron wire 0.165 inch in diameter, which is No. 8 B. W. G., and about No. 6 B. & S. gauge. Later the circuit on porcelain insulators was changed to No. 6 B. & S. copper wire 0.162 inch in diameter. The measured resistance of one of the iron-wire circuits was 66.25 ohms at —7 degrees C.

The Lightning Protection

The lightning protection was laid out by Mr. A. J. Wurts, who, previous to this time, had spent some months at Telluride, determining the requirements for protecting the 3,000-volt circuit. The protection consists of choke-coils and spark-gaps of non-arcing metal, as described by Mr. Wurts in his paper[1] before the Institute, March, 1892.

In each line 10 choke-coils were placed. Unit arresters, each consisting of seven non-arcing metal cylinders, and having six spark-gaps, were connected, as is shown in Fig. 3.

Running Tests at Telluride

The first tests were qualitative rather than quantitative. It was uncertain what phenomena might accompany the operation of a long line at high voltage, and the pressure which could be used on the insulators was a matter to be determined. The first thing was to find what would work; measurements could be made afterward. A high-voltage was placed on the transmission line, sometimes transmitting no power and at other times operating the 100 horse power synchronous motor. In December, 1895, the motor was operated at 25,000 to 33,000 volts for several days. In January, 1896, 45,000 volts was used continuously for over a week, and, beginning with the latter part of March, a continuous run of 37 days was made at 50,000 volts. "Some very severe conditions of weather were encountered during this time; very high gales of wind prevailed; the air was filled with clouds dust; part of the time the snow which fell was quite damp, and during the last few days of the run there was some rain. At this voltage the wires were plainly visible at night, and the characteristic hissing of high-tension currents could be heard several hundred feet. No lightning arresters had been installed up to this time, and the cause of the shut-down was damage to the raising transformer, caused by lightning. Lightning arresters were installed. The lightning season commenced about June 1st.

FIG 5. HIGH-VOLTAGE POWER TRANSMISSION.—INSULATORS USED IN HIGH-TENSION TESTS AT TELLURIDE.

During the latter part of June lightning discharges over the arresters were very frequent. At this time we were limited to a running voltage of about 34,000 volts, as there were not enough arresters to permit of increasing the voltage. No trouble whatever was had with the lightning protection. Discharges were frequently seen crossing the arresters, and during two or three days in the early part of the season discharges occurred at intervals of a few seconds for several hours. Enough arresters were afterward obtained to run at 45,000 volts, but the lightning discharges were much less frequent."

Electric Railways for Porto Rico.

In the development of Porto Rico General Roy Stone suggests that no attempt be made to construct long wagon roads, but that a network of light electric railways be built instead, to be used principally for the marketing of agricultural produce and the needs of rural communities. At present the roads are very bad. Transportation from the interior plantations is largely carried on by pack animals or by men or women bearing loads upon their heads. General Stone thinks that Porto Rico will never have a complete system of wagon roads. The enormous tropical rainfall and the mountainous nature of the country require for any road, to be worthy of the name, most thorough drainage and most careful foundations. The present military road across Porto Rico is estimated to have cost nearly $100,000 a mile.

General Stone argues that by electric lines a great saving can be made and at the same time better and more expeditious communication secured than any system of wagon roads would offer. The general adds that Porto Rico has many waterfalls, which could furnish power for all the trolley roads which the island could require, and points out that any attempt at railroading in Porto Rico should be by water power converted into electricity. The cost of coal is prohibitive of any large scheme of transportation, either by steam railroads or by electric lines deriving their power from steam-driven generators. The scheme seems feasible, and is exciting considerable attention.

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French naval authorities are recruiting for the electrical department and have issued instructions concerning the admission of volunteers for the service. A circular from the minister of the admiralty relating to tests to be required of the working electricians to be appointed to the vessels of the fleet has been addressed to the vice-admirals, the commander-in-chief and the maritime prefects. The term of service will be three years. The examining boards will be composed of naval officers and practical electrical and mechanical engineers, and it is directed that the examinations be held during the first 10 days of each month at a date that shall be fixed by the maritime prefect. These examinations will be of a practical and theoretical nature, and it is noticed that in the requirements especial attention is given the placing and operation of electric torpedoes and submarine mines. Attention is also devoted to the construction and operation of lighting and power plants, with special reference to their use on shipboard.

The electric railway has been put to many uses, but probably the most unique is that of an odd line used to convey guests from a hotel to their baths. Such a line is operated in connection with the palatial French hotel at Evian-les-Bains, where a small three-phase road has been built on the hotel grounds for the convenience of the guests in going to and returning from the hot baths, which are only 1,000 feet away. The trip takes two minutes. Passengers who were in extreme haste might ride on the front platform and save time by arriving that much in advance of less fortunate travelers on the rear end of the car, which, being five meters in length, reaches a comparatively long way down the road.

The line starts from the court of the hotel, and follows with many detours the shaded route through the beautiful park, terminating upon the terrace, from which the view of a splendid horizon is to be had. The beauty of the country and the comfort and elegance of the coach bring sad regrets to the bathers that the route is so short. The length of the road is 300 meters, the curves are sharp and the grades are steep, yet, as already mentioned, the entire trip up-hill requires only two minutes. The current for this mimic road is furnished by the lighting station at Chévenoz, 12 kilometers away. It is a three-phase plant, and furnishes current for the hotel and town as well.

Track-elevation work has progressed far enough to allow the operation of the trolley cars on Clark street, Chicago, which was closed during the summer. Last week the motor-smoker and trailer illustrated in the last issue of the Western Electrician was taken over the road, the mayor, commissioner of public works, engineers and other city officials accepting the invitation of Superintendent Nagle of the Chicago City Railway company to make the trip. The opening of this line will greatly relieve the congestion of traffic on State street and Wabash avenue. The most important feature of the new arrangement, however, is the fact that the question of downtown trolley lines is brought into prominence again. When the City Railway company secured permission to operate its trolley cars temporarily on State street and Wabash avenue last spring it agreed to remove its poles and wires when the Clark street viaduct was completed. In compliance with this promise and upon direction of the mayor the company prepared to keep its agreement, but taxpayers who had experienced the benefits of the trolley opposed the movement, and State street business men also declared in favor of allowing the poles to stand. An ordinance was introduced into the council, granting the company permission to operate electric cars in the business district, but the mayor declared his intention of fighting the measure. An attempt may be made to override the mayor's action. This would be important, as it would disclose the strength of the street-railway company in the council, and might indicate to the railway companies whether they could secure the 50-year extensions of their franchises.

It is just as well for inexperienced persons not to attempt to add electrical shocks to the mock terrors of secret-society initiations. Several instances of serious injury have been reported from this source, and although it is difficult to get at the facts in such cases, the fact that men have been hurt is sufficient to admonish "teams" of initiators that electricity should be avoided—at any rate unless an electrician of well-balanced judgment is in charge.

A case of injury in Port Byron, Ill., of this kind was made known last week. The newspapers state that Dr. William P. Sensibaugh, a dentist of the village named, is in a serious condition as a result of pranks played upon him while being initiated in a fraternal-insurance lodge in that village. In the course of the ceremonies he was blindfolded, and received several slight shocks from an electric circuit. The bandage over his eyes having become loosened, he sought to outwit those having fun at his expense by finding the wires and avoiding them. One of the initiating team, it is said, seeing that the candidate was about to evade the wires, gave him a little shove, which, unfortunately, proved sufficient to throw him off his balance, and he fell hands down upon the battery itself, according to the account, receiving a shock which rendered him unconscious.

It seems improbable that a battery apt to be used in a village lodge-room would have sufficient voltage to do such serious injury, and the account is probably exaggerated or inaccurate, but it is likely that the man was injured by some electrical means. The newspaper report gives a sad ending to the affair: "After working over him for two hours, and finally reviving him, it was discovered that his right arm hung limp and loose, and in this condition it has remained ever since. A week ago he was stricken with an affection of the pneumogastric nerve. Since then he has been kept up mainly through electrical treatment. One of the attending physicians says that paralysis of the nerves is threatened, in which event the sufferer cannot live."

We have no means of judging the accuracy of these statements, which may be colored by the imagination of the local correspondent. But it is nevertheless the part of prudence to leave electricity out of all initiatory capers, unless experienced men supervise the installation and operation of the apparatus. And even then the currents should be very weak unless the candidate has been passed upon by a physician.

The postmaster-general of Great Britain is besieged with petitions for franchises from cities and companies who desire to engage in the telephone-exchange business in competition with the National company. He has replied to all that the policy of the government has not yet been formulated and that nothing can be done by his department until decisive action is taken upon the parliamentary report now under consideration. In reply to a deputation from Manchester the postmaster-general added that he had no immediate intention of establishing Postoffice competition in a city like Manchester, where the Postoffice has not hitherto instituted any local exchange; that he had no intention of conferring any license on any private company for carrying on the business of a telephone exchange, and that, in the event of the report of the recent select committee being approved by the government, a bill would be introduced into Parliament to authorize the postmaster-general to grant provisional orders to enable a local authority to lay down and work telephones in its own district or the districts of other authorities within the exchange area. The postmaster-general was not in a position at the present time to state what conditions may be inserted in the license providing for the purchase by the Postoffice of the land, buildings and plant acquired by the corporation for the purposes of the exchange, but assurance was given that the recommendations of the select committee on the subject will have due consideration. The postmaster-general does not consider it any part of his duty to lay down the conditions on which local authorities should be allowed to borrow money for the purpose of opening a telephone exchange. In the event of any license being granted to a municipality the postmaster-general would not propose that it should extend over an area larger than that already granted to the National Telephone company.

In the meantime public sentiment seems to be growing in favor of the government absorbing the telephone business and conducting it as a part of the Postoffice after the manner of the telegraph bureau. One of the arguments advanced in favor of such a course is based upon the objection that under the present arrangement telephonic secrecy is impossible; that information is systematically and illegally obtained and used; that business plans and transactions are constantly upset, and all because the fundamental principles which should govern a telephone system are willfully ignored. An English contemporary asks: "Is the commercial public going to remain satisfied with this condition of things or will secrecy be insisted upon?" It is pointed out that the time for useful agitation is the present, "when things are in a transitive state, with everything unsettled," and, furthermore, the warning is sounded that it will be too late to complain when thousands of millions of pounds have been spent in installing apparatus of the usual kind.

Transmission of Power Through the Air Without Wires.[1]

By Prof. John Trowbridge.

Mr. Tesla has recently patented a method of transmitting power through the air without the use of wires. This method consists in producing a very great difference of potential between a high point in the atmosphere, reached by a wire connected to a balloon, and a distant point on a balloon, which in turn is connected through a step-down transformer with the earth. A step-up transformer produces the high potential at the sending station, or at the first balloon, and the difference of potential thus created produces a current of conduction through the rarefied air to the second balloon and thence through the step-down transformer to earth. Mr. Tesla relies upon the good conductivity of rarefied air to high electromotive force.

Some recent experiments I have made with high electromotive force are interesting in regard to the suggestion of Mr. Tesla, and are in continuation of those I described in the Scientific American for January 15, 1898. At that time my apparatus was capable of producing 1,200,000 volts. It can now produce 3,000,000.

Up to the point of one million and a half volts, the length of the electrical discharge in air appears to be closely proportional to the electromotive force. When this voltage is exceeded, the length of the spark no longer increases in proportion to this force, for instance, and electromotive force of approximately 3,000,000 volts produces a spark of about seven feet in length, when it should excite one at least 10 feet long. The reason of this diminution is readily seen when the operation of my apparatus is examined in the dark.

From both terminals and from the conductors to those terminals there is a luminous brush discharge to the walls and floor of the room. The main portion of the discharge is, so to speak, shunted through the air, which breaks down with facility at such high voltages. The high electromotive force exerts a similar action to that of diminished air pressure.

In the case of rarefied air, one sees the luminous area of discharge on the positive terminal extend farther and farther from the point of the terminal, thus indicating that there is an increased flow through the rarefied air. In ordinary atmospheric air the same increase of electrical conductivity takes place under the action of great electromotive force. When discharges produced by 1,000,000 volts or more are excited between terminals six feet apart, in tubes filled with water, the tubes are speedily burst, and when the phenomenon is carefully examined, it is perceived that the disruptive sparks occur on the surface of the water inside the tubes, which vaporize the water and thus lead to an explosion. The layer of air conducts more readily than the water. The same phenomenon can be shown by interposing a conductor made of plumbago and infusorial earth, making a resistance of about 10,000 ohms between the terminals of the apparatus. A spark passes over the surface of such a conductor through the air, if the length of such a conductor does not exceed 10 or 12 inches.

I found also that the spark preferred to jump through five centimeters of air to passing through a thousand ohms of a copper-sulphate solution. Thus the air evidently breaks down with increasing readiness when the electromotive force is increased beyond a certain limit.

One of the most striking experiments in this connection can be performed by coating a board with a thin layer of plumbago, which is polished upon the surface in such a manner as to make a resistance of about 1,000 ohms between broad terminal bands of copper. When a discharge under a difference of potential of 1,000,000 volts passes between the terminal bands, the entire surface of the conductor becomes luminous.

When my new apparatus was first set up, the coated surfaces of the Leyden jars were not more than a foot from the floor. On account of the great loss due to electrostatic induction, I determined to have the entire apparatus lifted three feet from the floor. A certain portion of the loss was thus obviated, but when discharge takes place, sparks an inch long can be drawn from the neighboring brick walls, and the entire room seems to be filled with brush discharges.

I believe, therefore, that beyond 1,000,000 volts, the length of the spark is no longer proportional to the voltage, and that this departure from proportionality is due to the initial resistance of the neighboring air becoming less and less. In order to get the full effect of the voltage of my machine, I believe that it should be placed 30 or 40 feet above the earth and at a distance from neighboring masses. The apparent length of lightning discharges at low altitudes is therefore no criterion of the voltage which produces these discharges, for there must be great leakage, which necessitates an excess of electromotive force to produce the discharge. On the other hand, the discharges in higher regions of the atmosphere are much lengthened on account of the increased conductivity of the medium.

In view of the experiments which I have described, I am led to believe that ordinary atmospheric air under very high voltage acts like a fairly good conductor, and I can conceive of such a high electromotive force that the initial resistance of air might not be more than the resistance of metals. The loss of electrical energy in producing difference of potential of 3,000,000 volts at a distance of 10 feet from the terminals of my machine is very great, and in employing such high voltages Mr. Tesla could only obviate great loss by lifting his entire generating apparatus far above the surface of the earth.

1. From the Scientific American.

Tesla Describes His Investigations.

[From the New York Sun.]

I cannot but gratefully acknowledge my indebtedness to earlier workers, as Dr. Hertz and Dr. Lodge, in my efforts to produce a practical and economical lighting system on the lines which I first disclosed in a lecture at Columbia College in 1891. There exists a popular error in regard to this light, inasmuch as it is believed that it can be obtained without generation of heat. The enthusiasm of Dr. Lodge is probably responsible for this error, which I have pointed out early by showing the impossibility of reaching a high vibration without going through the lower or fundamental tones. On purely theoretical grounds such a result is thinkable, but it would imply a device for starting the vibrations of unattainable qualities, inasmuch as it would have to be entirely devoid of inertia and other properties of matter. Though I have conceptions in this regard, I dismiss for the present this proposition as being impossible. We cannot produce light without heat, but we can surely produce a more efficient light than that obtained in the incandescent lamp, which, though a beautiful invention, is sadly lacking in the feature of efficiency. As the first step toward this realization I found it necessary to invent some method for transforming economically the ordinary currents as furnished from the lighting circuits into electrical vibrations of great rapidity. This was a difficult problem, and it was only recently that I was able to announce its practical and thoroughly satisfactory solution. But this was not the only requirement in a system of this kind. It was necessary also to increase the intensity of the light, which at first was very feeble. In this direction, too, I met with complete success, so that at present I am producing a thoroughly serviceable and economical light of any desired intensity. I do not mean to say that this system will revolutionize those in use at present, which have resulted from the co-operation of many able men; I am only sure that it will have its fields of usefulness.

As to the idea of rendering the energy of the sun available for industrial purposes, it fascinated me early, but I must admit it was only long after I discovered the rotating magnetic field that it took a firm hold upon my mind. In assailing the problem I found two possible ways of solving it. Either power was to be developed on the spot by converting the energy of the sun's radiations or the energy of vast reservoirs was to be transmitted economically to any distance. Though there were other possible sources of economical power, only the two solutions mentioned offer the ideal feature of power being obtained without any consumption of material. After long thought I finally arrived at two solutions, but on the first of these, namely, that referring to the development of power in any locality from the sun's radiations, I cannot dwell at present. The system of power transmisson without wires, in the form in which I have described it recently, originated in this manner: Starting from the two facts that the earth was a conductor insulated in space and that a body cannot be charged without causing an equivalent displacement of electricity in the earth, I undertook to construct a machine suited for creating as large a displacement as possible of the earth's electricity.

This machine was simply to charge and discharge in rapid succession a body insulated in space, thus altering periodically the amount of electricity in the earth, and, consequently, the pressure all over its surface. It was nothing but what in mechanics is a pump, forcing water from a large reservoir into a small one and back again. Primarily, I contemplated only the sending of messages to great distances in this manner, and I described the scheme in detail, pointing out on that occasion the importance of ascertaining certain electrical conditions of the earth. The attractive feature of this plan was that the intensity of the signals should diminish very little with the distance, and, in fact, should not diminish at all, if it were not for certain losses occurring chiefly in the atmosphere. As all my previous ideas, this one, too, received the treatment of Marsyas, but it forms, nevertheless, the basis of what is now know as "wireless telegraphy." This statement will bear rigorous examination, but it is not made with the intent of detracting from the merit of others. On the contrary, it is with great pleasure that I acknowledge the early work of Dr. Lodge, the brilliant experiments of Marconi, and of a later experimenter in this line, Dr. Slaby of Berlin. Now, this idea I extended to a system of power transmission, and I submitted it to Helmholtz on the occasion of his visit to this country. He unhesitatingly said that power could certainly be transmitted in this manner, but he doubted that I could ever produce an apparatus capable of creating the high pressures of a number of millions of volts which were required to attack the problem with any chance of success, and that I could overcome the difficulties of insulation. Impossible as this problem seemed at first, I was fortunate to master it in a comparatively short time, and it was in perfecting this apparatus that I came to a turning point in the development of this idea. I, namely, at once observed that the air, which is a perfect insulator for currents produced by ordinary apparatus, was easily traversed by currents furnished by my improved machine, giving a tension of something like two and a half million volts. A further investigation in this direction led to another valuable fact, namely, that the conductivity of the air for these currents increased very rapidly with its degree of rarefaction, and at once the transmission of energy through the upper strata of the air, which, without such results as I have obtained, would be nothing more than a dream, became easily realizable. This appears all the more certain, as I found it quite practicable to transmit, under conditions such as exist in heights well explored, electrical energy in large amounts. I have thus overcome all the chief obstacles which originally stood in the way, and the success of my system now rests merely on engineering skill.

Referring to my latest invention, I wish to bring out a point which has been overlooked. I arrived, as has been stated, at the idea through entirely abstract speculations on the human organism, which I conceived to be a self-propelling machine, the motions of which are governed by impressions received through the eye. Endeavoring to construct a mechanical model resembling in its essential, material features the human body, I was led to combine a controlling device, or organ sensitive to certain waves, with a body provided with propelling and directing mechanism, and the rest naturally followed. Originally the idea interested me only from the scientific point of view, but I soon saw that I had made a departure which sooner or later must produce a profound change in things and conditions presently existing. I hope this change will be for the good only, for, if it were otherwise, I wish that I had never made the invention. The future may or may not bear out my present convictions, but I cannot refrain from saying that it is difficult for me to see at present how, with such a principle brought to great perfection, as it undoubtedly will be in the course of time, guns can maintain themselves as weapons. We shall be able, by availing ourselves of this advance, to send a projectile at much greater distance; it will not be limited in any way by weight or amount of explosive charge; we shall be able to submerge it at command, to arrest it in its flight, and call it back, and to send it out again and explode it at will, and, more than this, it will never make a miss, since all chance in this regard, if hitting the object of attack were at all required, is eliminated. But the chief feature of such a weapon is still to be told, namely, it may be made to respond only to a certain note or tune; it may be endowed with selective power. Directly such an arm is produced, it becomes almost impossible to meet it with a corresponding development. It is in this feature, perhaps, more than in its power of destruction, that its tendency to arrest the development of arms and to stop warfare will reside.

With renewed thanks, I remain, very truly yours,

N. TESLA.

New York, November 19, 1898.

Stationary Motors on Trolley Circuits.

In the matter of the commercial operation of motors on grounded trolley circuits, the Chicago General Railway company returns valiantly to the charge after two setbacks by the city. Mr. Ellicott, the city electrician, holds that this practice contravenes the safe-wiring ordinance of the city of Chicago. He caused the cutting of a wire connecting the company's trolley circuit with a motor, and the company cited him to appear in a state court to give a bond to preserve the peace. Judge Dunne heard the case and decided that no offense had been committed. Then the company carried the controversy to the United States Court, but Judge Grosscup lately decided that he had no jurisdiction. Now the company is in the state courts again. Last week Judge Tuthill issued an injunction restraining the city of Chicago and Edward B. Ellicott, city electrician, from interfering with the operations of the company in its proposed connection with the feed wires in Kedzie avenue, Twenty-second and Throop streets. The company alleges that it secured permission to make the connections under a permit issued by the City Council in October, 1897. It declares that ordinances were passed afterward, under which the city authorities threatened to cut the connections already made and prevent the further stringing of wires by the Chicago General company. The company holds that the ordinances in question are unconstitutional, being in violation of the law of contracts.

The Perth Tramways syndicate of London is building an electric railway in the city of Perth, Western Australia, and to Subiaco, Leaderville and Freemantle, suburbs of Perth, which, when finished, will have a total mileage of between 30 and 40 miles. At present, 10 miles is being built in the city proper, part single and part double track. A second 10 miles will be laid on completion of the first section. All the equipment will be American, with the exception of the girder-groove rails from England. The power plant will be built to develop 2,300 horse power.

DEVELOPMENT OF THE TELEPHONE FIELD.

False Economy in Telephone Construction.

An "electrical contractor" had undertaken to equip a house, barn and carriage-house with telephone instruments, arranged in such a manner that either the barn or carriage-house telephone could be selectively called from the house telephone, and, accordingly, he procured three telephones of a type shown in the accompanying diagrams, and separately placed batteries. Armed with a diagram for connections (Fig. 1), it was but a matter of a few hours when, with an assistant, he succeeded in installing the telephones. Making a preliminary test by short-circuiting the telephones at the line binding-posts and speaking into the transmitter, the usual loud "back talk" was heard, which served as an assurance that the local circuit of the instruments at least was in proper working order. It only remained now to test from the house to the barn and from the house to the carriage-house. Dispatching his assistant to the barn, and instructing him to wait

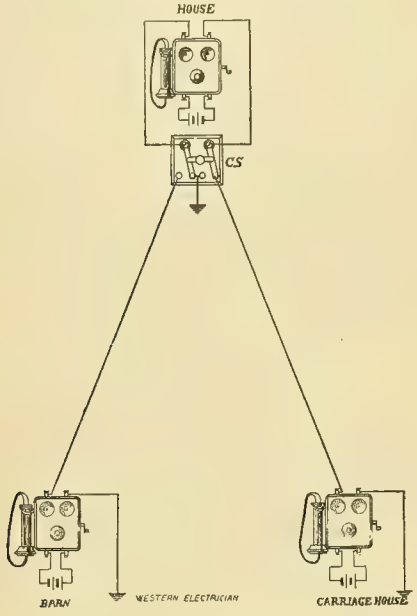


FIG. 1. FALSE ECONOMY IN TELEPHONE CONSTRUCTION.

until he heard a ring, the contractor placed the switch lever C S to the left, and rang up, receiving an answering ring. Placing the telephone receiver to his ear, he spoke to his assistant without any particular trouble, excepting that the assistant's voice appeared to be rather faint, whereas the assistant assured the contractor that the latter's voice came up very strong. This part of the test being fairly satisfactory, the assistant was dispatched to the carriage-house. Placing the switch lever C S to the right, the contractor called up the carriage-house telephone and received an answering ring, when, proceeding as before, he placed the telephone receiver to his ear and received the assistant's loud "hello." On responding, he discovered that the assistant did not appear to hear anything of what was being said to him. Examining the battery connections, as also the line terminals, and changing them about, the contractor had the satisfaction of "fixing the trouble;" that is, he succeeded in communicating with the assistant; then, "just for luck," he instructed the assistant to return to the barn telephone and answer from there. When the switch was thrown to the left and the barn again called up the response came up good and strong, but the contractor could not make his assistant understand any part of the conversation. After a few more fruitless changes, the contractor became disgusted with the problem and called to his aid an inspector regularly employed by the manufacturer of the telephones installed, who, after learning what effects had been observed, commenced by tracing out the battery circuits at the house telephone, which led him to a set of batteries connecting to the gas-lighting system in the building. A few changes, which consisted in cutting one of the batteries clear from the rest, were deemed necessary, another test of the telephone system was made and everything found to be operating perfectly. Briefly, in attempting to avoid installing new batteries at the house telephone, the contractor had utilized the gas-lighting battery for the purpose, with the result that whenever the switch lever a rested on the E S point (Fig. 2) the transmitter battery was short-circuited as follows: G B, E, E S, a, L, P S, and S T, I P back to G B. However, with the switch a on the telephone line, the transmitter battery would not be short-circuited direct, being obliged to pass though the distant telephone. The house-telephone receiver in this case, however, did not receive very much current, for the primary circuit practically formed a parallel branch with it, as will be observed by tracing out the circuits shown by Fig. 2.

Telephony in Great Britain.[1]

By W. H. Preece.

I was sent, in 1877, together with Sir Henry Fischer, to investigate the telegraph system of the American continent, and especially to inquire into the accuracy of the incredible report that a young Scotchman, named Bell, had succeeded in transmitting the human voice along wires to great distances by electricity. I returned from the United States with the first pair of practical instruments that reached this country. They differed but little from the instrument that is used to-day to receive the sounds. The receiver, the part of the telephone that converts the energy of electric currents into sounds that reproduce speech, sprang nearly perfect in all its beauty and startling effect from the hands of Graham Bell. But the transmitting portion, that part which transforms the energy of the human voice into electric currents, has constantly been improved since Edison and Hughes showed us how to use the varying resistance of carbon in a loose condition, subject to change of pressure and of motion under the influence of sonorous vibrations. The third portion, the circuit, is that to the improvement of which I have devoted my special attention. Speech is now practically possible between any two post-offices in the United Kingdom. We can also speak between many important towns in England and in France. It is theoretically possible to talk with every capital in Europe, and we are now considering the submersion of special telephone cables to Belgium, Holland and Germany. The progress of the use of the telephone in Great Britain has been checked by financial complications. It fell into the hands of the company promoter. It has remained the shuttlecock of the Stock Exchange. It is the function of the postmaster-general to work for the public every system of intercommunication of thought which affects the interests of the whole nation. Telephony is an imperial business, like the post and the telegraph. It ought to be in the hands of the state. The public and the press have frequently kicked violently against the present régime. Committees of Parliament have sat and deliberated upon the question. The report of the last committee is now under consideration.

"Quidquid delirant reges, plectuntur Achivi." Two causes exist to impede this desirable absorption —the fear of being "done" by watered and inflated capital and the assumed bad bargain made in absorbing the telegraphs in 1869. The former is a mere bugbear. The public does not want to purchase stock. It wants to acquire a plant and business which can be easily and fairly valued. The latter is a gross fallacy. The business of the telegraph companies—practically an unlimited monopoly —was purchased on absolutely fair terms, viz., 20 years' purchase of the net profits. The sum paid was £4,989,048. The number of messages then sent in one year was about 5,000,000, and the gross income about £500,000. The income has now grown to £3,071,723; the number of messages has reached 83,029,999, and the capital account, which was closed in 1891, viz., £10,131,129, including the cost of the Postoffice extensions, remained the same. If a syndicate desired now to repurchase the business and acquire the plant, it would have to find a capital of over £30,000,000. In what respect, then, was the transfer of the telegraphs to the state a failure? Our magnificent system has been built virtually out of revenue; our tariff is very cheap; scarcely a village of any consequence is without its telegraph; our press is virtually subsidized by having its news supplied it at much less than cost price; we can rely upon safe and accurate delivery and upon speedy dispatch of messages. We lead the world. There has been no failure, and there was no bad bargain. The present condition of the telephone business in this country is shown by the following return:

Telephones in Use June 30, 1898.

National Telephone company	133,498
General Postoffice	9,588
Railway companies	8,933
Total	152,019

1. Abstract from presidential address before Institution of Civil Engineers at London.

Independent Exchange at St. Louis.

[From the St. Louis Post-Dispatch. November 18th.]

Within 12 days the Kinloch Telephone company will have 750 instruments in operation. Each week thereafter 500 instruments will be added to the list until the entire 4,500 instruments now contracted for and connected are in use.

Hopkins J. Hanford, the general manager, said the first book would be issued on or before December 1st, and there would be 750 names on the book. Already there are more than 600 instruments ready for use that are being used every day by Kinloch employes. These instruments are scattered all over the city, and the employes are merely testing them.

Within a week after the first book is issued a new book will be printed. Messengers will go to Kinloch customers and take up the old books and leave a new one. So at the end of the first week after the exchange is open to the public 1,250 instruments will be in use. Mr. Hanford says new books will be issued weekly, containing 500 new names, until the exchange is run to full capacity.

Mr. Hanford says it is necessary to open the monster exchange on the installment plan. The telephone girls are all new and were the entire 4,500 instruments to be put in operation at once the girls would be so rattled they could not answer calls promptly and the public would be given a bad impression of the new system, which authorities say is one of the most complete and perfect ever put into any city.

On the tenth floor of the Century building is the switchboard room of the new telephone company.

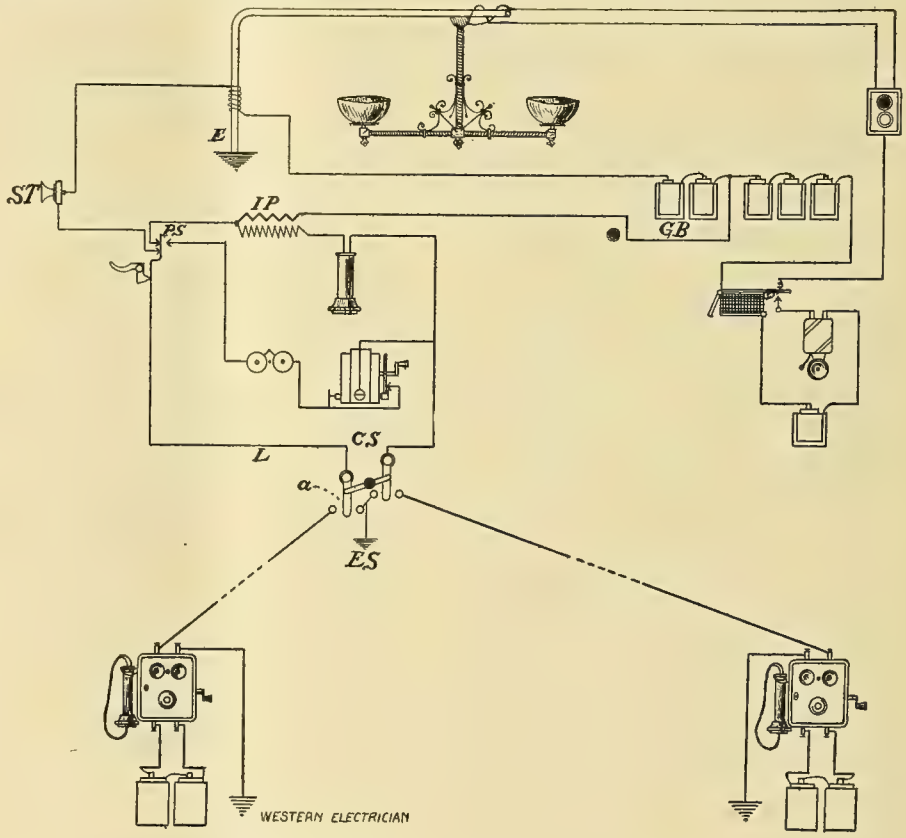


FIG. 2. FALSE ECONOMY IN TELEPHONE CONSTRUCTION.

The monster switchboard is in four sections, and 50 girls are at their places answering calls and familiarizing themselves with the work.

As they become familiar with what is required of them a less number in proportion will be needed. Mr. Hanford thinks that with the 4,500 instruments in use it will require about 85 girls to answer all calls. Though he can use less than 100, more than 700 girls have made applications for positions.

Besides using the entire upper floor of the Century building, the Kinloch people also occupy a big room in the northeast corner of the basement. It is in this basement room that the wires from the nearly 5,000 instruments enter the building. They come in large lines of lead pipe, 200 copper wires being inclosed in each pipe. These wires are then connected with lightning arresters to prevent their being burned out. From there they are led up through an immense smokestack-looking concern to the tenth floor, where they are connected with the terminal board. Then they are led under a false floor to the switchboard.

This basement room is fitted out with many intricate machines. One machine there will register whenever any machine in any part of the city is out of order. The cables and walls are all painted white, and the room is lighted until it is as bright as day.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Central Wisconsin Telephone company is arranging a traffic deal by which it will connect at Black River Falls, Wis., with the Greenwood line, and will thus secure considerably larger toll connections.

The Northwestern Telephone Exchange company has completed the long-distance line between Fisher, Minn., and Grand Forks, N. D. The company has bought the line of E. M. Walsh between Crookston and Fisher, Minn.

The Central Minnesota Telephone company will soon complete connection with Pine City, Minn.

The Little Wolf River Telephone company is working on a toll line to Berlin, Wis. The poles have reached Omro, where there will be a central office for a large circuit when all the contemplated lines are completed. An exchange will be put in at Omro also.

F. C. Talboys and Dr. More are constructing a telephone line on the Mesaba range, between Sparta and Virginia, Minn., by way of Eveleth. The system is about ready for operation.

The Marquette County Telephone company of Marquette, Mich., is making a number of improvements in its system and adding a number of new toll wires.

The Inland Telephone and Telegraph company has completed toll connections to Northport, Wash., near the northern boundary of the state. Connection is now possible from Northport to San Francisco, a distance of 1,400 miles. Connection is also completed between Washington points and Boise City, Idaho. The company has decided to bury its wires at Spokane, Wash., and to have the work done within a year. The total cost is placed at about $100,000.

The dispute over the ownership and control of the telephone company at Meyers Falls, Wash., has reached the point where arrests for malicious interference with the system have begun. A warrant has been sworn out against N. R. Stone, charged with maliciously destroying the property, a'so against his lineman. Mr. Stone has sworn out warrants for the same offense against W. B. Aris, S. Cleger, Mr. Tively and Charles Chamberlain. Stone appeared in Meyers Falls, armed with an order from the court commanding the old officers of the company to deliver the property to him. He failed to get service, and then proceeded to get connection with another telephone, when he was interrupted by the appearance of Aris. Aris at once tore down the wire and prevented the connection being made.

The Clearfield and Mount Ayr Telephone company has recently installed a system in Mount Ayr, Ia., under permission from the council. At the late election a competitor had quietly applied for a franchise to be voted on by the people, as the law requires. The former company supposed it was in possession of a franchise until the fact came out of the competitor's application being voted on. The newcomer was defeated, and the first company will be allowed to remain until the spring election, when the matter will be voted on.

The Iowa Telephone company was voted a franchise at the late election by the citizens of Reinbeck, Iowa.

The Perry Telephone company has been granted a franchise for an exchange at Stuart, Ia., by popular vote.

The Knoxville Electric company has been granted a franchise for a telephone toll line to Pleasantvil'e, Ia. The line will be extended to Des Moines, through Indianola.

The Central Dakota Telephone company is rapidly pushing its line from Brookings, S. D., to Miller.

The Forman Telephone company proposes to extend its wires to Lidgerwood, N. D.

Albert Lea, Minn., now has connection with Geneva, Cooleyville, Clark's Grove, Twin Lakes and Clover.

Harmony, Minn., just at present belies its name. Last spring V. H. Stevens of Waterville, Ia., came to Harmony and made arrangements with the Farmers' Telephone company to use its poles, and then asked donations of the Harmony business men for aid to extend the lines to that place. Herman Achatz circulated the petition and was quite successful. From the money so collected the line was built. The Achatzs were allowed to act as operators. Fred Achatz is a member of the Village Council, and on November 1st the council granted to F. F. and Herman J. Achatz the absolute right and full control of the only central telephone exchange in the village. The matter has aroused the ire of the citizens intensely.

The Northern Minnesota Telephone company has completed its lines connecting Park Rapids, Hubbard, Latona and Menahga, Minn. Lines will soon be extended to Pine Point, Badoura, Wadena and Parkers Prairie, via Henning.

The Badger State Long-distance Telephone company is about to build an exchange at Janesville, Wis. It is announced the company will start with 400 subscribers in Janesville. A toll system to surrounding towns is to be built.

Telephone connection has just been completed to Clafk, Neb.

The Cedar Valley Telephone company has completed connection from Waterloo, Ia., to Waverly, by way of Cedar Falls and Janesville.

William I. Thraikill of Des Moines succeeds O. R. Cole as district manager for the Iowa Telephone company's office at Red Oak, Ia.

The Litchfield Telephone Exchange company will build a line from Litchfield to Manannah, Minn., 12 miles north, at once.

The Minnesota Central Telephone company has connected its toll line with the local exchange at Litchfield, Minn.

Extensions and Improvements.

The Union (S. C.) Extension Telephone company will extend its lines throughout the state at once.

Fifty Bell telephones were burned out last month at Pontiac, Mich., by the crossing of an electric street-car wire and the telephone wire.

The rate war in Atchison, Kan., has brought the telephone service rentals down to $12 per year for business houses and $9 for residence telephones.

The Inland Telephone company has reached Sidney, Ohio, with its line connecting the towns in the northern part of the county with Sidney.

The Inland Telephone company is arranging a metallic copper wire between Spokane, Wash., and Nelson, B. C., which will soon be in operation.

The Mansfield (Ohio) Telephone company has elected officers as follows: President, S. N. Ford; vice-president, J. F. Boals; secretary, J. L. Baxter; treasurer, M. D. Ward.

The material for building an additional telephone line from Independence, Ore., to Salem, Dallas and Monmouth has arrived and work on the line will be commenced at once.

The contract for building a telephone line from Point Arens to the lighthouse at Mendocine, Cal., has been let by the government to J. M. Klein & Co. of San Francisco for $776.

The Home Telephone company of Forest Grove, Ore., has placed an order for poles and expects to reach Portland before spring and make connections with the Columbia system of that city.

Arrangements were completed recently for building a telephone line to Sherar bridge on the Deschutes River, 30 miles from The Dalles, Ore. Branch lines will also be built to Prineville.

The People's Telephone company contemplates the erection of a three-story fireproof exchange at Knoxville, Tenn., and in addition to this improvement the company will put all the wires under ground.

E. Nelzer, manager of the Eastern Oregon Gold Mining company, has let a contract for a complete telephone system, connecting the mine, mill and boarding-house with the through line to Baker City, Ore.

Dr. L. H. Milligan and J. W. Sams have purchased a controlling interest in the Morristown (Tenn.) Telephone company, and Dr. Milligan is now in charge of the company's affairs. A new switchboard will be put in soon and a better service in every particular is promised.

A telephone line from Sparta, Tenn., to Crossville is now assured. Manager J. N. Cox of the Gainesboro Telephone company has let the contract for the poles. This line will prove of great benefit to both White and Cumberland counties. Work will be begun on the line the first of the month.

Henry A. Coit of St. Louis has secured a franchise from Nebraska City, Neb., permitting the erection and operation of another telephone exchange. The rates provided in the ordinance are $24 per year for business houses and $12 for residences. Work has already been commenced on the new line.

The question of granting the People's Mutual Telephone company an extension of one year in which to comply with the terms of its franchise was brought before the street committee of the supervisors of San Francisco, and Herman de Laguna opposed the request, as he wished to compete for the franchise.

It is announced from Anaconda, Mont., that in a few months Butte and other cities of Montana will be connected by a long-distance telephone with all points on the Pacific Coast as far south as San Diego and north to British Columbia. The Rocky Mountain Bell company controls the Bell system for Montana, Idaho, Wyoming and Utah.

The telephone connection between the Ogle County Telephone company and the DeKalb County Telephone company was made reecntly at Creston, Ill., which gives the Rochelle patrons communication with Malta, DeKalb, Sycamore in the northern part of DeKalb County, also Belvidere in Boone County.

The People's Telephone company of Wayne and Monroe counties, Michigan, issued a dividend of 10 per cent. to stockholders, and elected the following-named officers: President, Joseph Waltz; secretary, F. L. Edwards; treasurer, W. S. Mercy; directors, T. J. A. Mullien, Jesse Butler, Joseph Waltz, F. L. Edwards, W. S. Morey and Benjamin Hall.

The new directory just issued by the Kalamazoo Mutual Telephone company contains about 100 more names than the last directory. In addition to the Kalamazoo subscribers the names of those of the Plainwell, Otsego, Pawpaw, Vicksburg, Marcellus, Decatur, Lawton and Wayland exchanges also appear. The information in the book is neatly and conveniently arranged.

J. H. Thatcher, superintendent of the Oregon Telephone and Telegraph company, has received a message from J. S. Sabin, general manager, instructing him to furnish telephone service to every town in Tillamook and Clatsop counties, connecting them with the company's general Pacific Coast system. Bids to furnish poles will be advertised for, the distance to be covered being about 125 miles.

There is a local telephone company at Rushford, Minn., that has about 150 miles of line. When the Union Electric company sold out to the Northwestern Telephone company it cut the Rushford lines from any connection with the outside world. In order to overcome this the Rushford company has commenced to extend lines to La Crosse and will build to Spring Valley before snow flies, by way of Preston, Fountain and Wykoff.

The Central Union Telephone company has completed its line to Kirkland from Belvidere and is now at work on the extension to Genoa. The company is having some trouble in getting the right-of-way from Genoa to Sycamore, Ill. On this account it may abandon that route and build a line from Kirkland to Clare, thence to Sycamore, connecting with its line there. The business men at Clare have subscribed for coupons to the amount of $100.

The contract for the erection of the new building for the Central Union Telephone company at Peoria, Ill., has been awarded. Work on the new building will be pushed as rapidly as possible. It is to be erected on the property recently acquired by the telephone company on Fulton street between Adams and Jefferson, and will be three stories in height and of brick. The dimensions are to be 48 by 75 feet. It will cost in the neighborhood of $20,000.

R. G. Hart, manager of the New State Telephone company at Lapeer, Mich., says that the system is being extended to all parts of the state and that many new subscribers are being added. A large exchange is being built at Jackson, and toll lines will soon be extended from Davison to Flint, Atlas, Goodrich, Grand Blanc and Ortonville; also from Flint to Flushing and Fenton. At Flint the company will connect with the large exchange operated by the Valley company, also with the toll lines to Saginaw, Bay City and other northern points.

Assistant General Manager George A. Paddock of the Empire State Telephone company of Auburn, N. Y., was notified by the Department of Works of Oswego on October 31st, that unless his company agreed to join in the combination pole scheme at once the wires and poles of his line would be torn down without delay. Several weeks ago a copy of the agreement entered into between the city and the other interested companies having wires and poles along the thoroughfare was sent Mr. Paddock, and nothing has been heard from him, notwithstanding the fact that innumerable demands have since been made for the return of the copy. The board is now ready for action.

An ordinance granting the Hanamo Telephone company permission to erect poles and string wires in the streets of St. Joseph, Mo., is now under consideration. The Hanamo company wants to build a connection with its system of toll lines into St. Joseph and the stockyards. The company's lines now extend over several of the most prosperous counties in Northwest Missouri. Most of the stockholders are Maryville men, and R. E. Ralston of that city is president of the company. The company has toll lines and owns or controls several local systems in northwest Missouri towns. Many of the farmers and stockmen of that part of the country also have instruments connected with the company's system in their houses. It is the intention of the company to give its subscribers direct connection with the stock market at St. Joseph.

New Binding-post.

The illustrations show a new binding-post manufactured by the Williams Electric company of Cleveland and applied to its double and single-pole receivers and the magneto bells. Fig. 1 is an elevation in one direction; Fig. 2 is the same elevation in the opposite direction, showing how the binding-post is applied to the cabinet work of the magneto bells, and Fig. 3 is a plan view, looking down upon the binding-post.

The body or base-piece of the binding-post is formed from spring-sheet Craig silver. Turned up from the same piece of metal are two spring clips S, which form a saddle or rest for the receiver-cord tip T. Screw B, on being rotated in the right-hand direction, screws through the nut until one side of

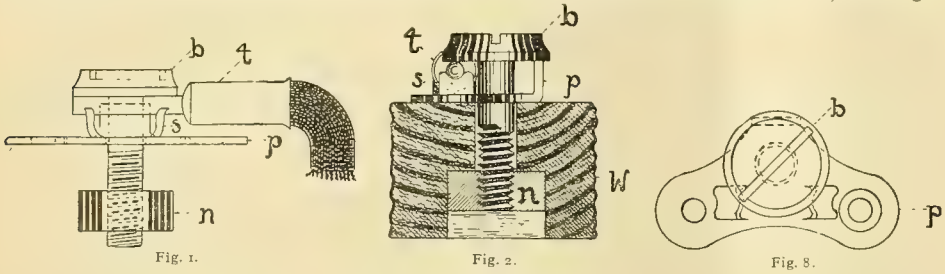


Fig. 1. Fig. 2. Fig. 3.

NEW BINDING-POST.

the screw-head grips the receiver-cord tip T, and on further rotation the screw locks the connection, screw B forces down the spring saddle S by spreading the limbs slightly outwardly until the screw engages the upwardly turned flange or base-piece P, and in this manner forms a perfect spring-lock for the receiver-cord tip. Fig. 1 shows the binding-post just after the screw-head has engaged the receiver-cord tip, and Fig. 2 shows the binding-post after screw B has forced the receiver-cord tip down lower and locked it by engaging the upwardly turned flange P on the opposite side of the screw-head. After screw B is forced down until it engages the flange P (Fig. 2), resistance is offered to the movement of the cord tip in either direction by the tendency of either one of the limbs to straighten up and grip the cord tip still tighter.

Wright Discount Meter.

Probably no subject of central-station management has attracted so much attention during the last few years as the matter of charging for current. In the early days of commercial lighting the electrical companies allowed their eagerness for business to induce them to take customers on all kinds of arrangements, and, as a result, many plants were operated at a positive loss. This eventually resulted in poor service and dissatisfaction, or readjustment of rates—provided the company did not in the meantime go into the hands of a receiver. The main consideration in the discussion of this feature of the business of late has been to determine an equitable arrangement by which each consumer would pay his proportion of the cost of operation of the central station, based upon the service enjoyed and the amount of current consumed. This can only be determined by taking into consideration several factors which enter into the management of the central station. As a result of this investigation the Wright demand system has been evolved and several important central stations have adopted the Wright discount meter for general use.

This instrument is a maximum recording amperemeter for direct or alternating currents, and records the maximum amperes that have passed through it at any one time since it was last set. It is slow acting, so that if the maximum load lasts only five minutes, the meter will register about 80

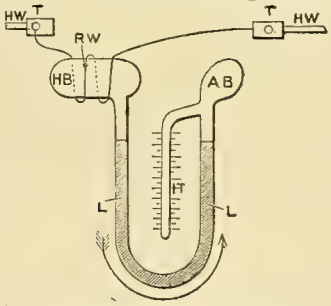


Fig. 1. Diagram of Connections. T, Terminals. H W, House wires; R W, Resistance wire; H B, Heated bulb; A B, Air bulb; I T, Indicating tube; L, Liquid.

per cent.; if 10 minutes 95 per cent., and the full 100 per cent. when the load has continuerd half an hour.

Fig. 1 shows the working parts in principle. A liquid is hermetically sealed in a glass bulb, around which the wires or heating strip pass. The current heats the air in the left-hand bulb and the expansion of the air forces the liquid into the right-hand bulb and indicating tube. The liquid, when once spilled over into the indicating tube, cannot return until the meter is reset.

Fig. 2 is exterior view of the meter. The working parts are enclosed in an iron case, fitted with a glass front so that the meter can be read without having to open the hinged door. It will be seen by reference to Fig. 3 that the glass tube is carried on a substantial backing, which is so hinged that the meter can be reset by tipping up the tube and allowing the liquid to run back out of the indicating tube into the side tubes.

In practice the meter is connected in series with the recording wattmeter or chemical meter, and registers in amperes the maximum demand on the station at any one time. The customer may be charged at one rate for the first hour's use of the maximum demand each day, and for all electrical energy used in excess of this at a much lower rate.

In order to facilitate the reading of the meter and the determination of the customer's bill, the Wright discount meter scale may be so calibrated that on one side it will read in amperes, and on the other directly in watt-hours, without any calculation, the amount of electricity to be paid for monthly at the full rate.

To arrive at the amount of electricity to be paid for at the low rate, subtract the watt-hours as shown by the reading of the Wright discount meter from the watt-hours as shown by the recording wattmeter or chemical meter, according to the type of meter used, and the difference between these two readings will represent the watt-hours to be charged for at the low rate. Of course the application of the principle and details may be modified to suit local conditions.

The Wright Discount Meter company, manufacturer of this instrument, announces that it has found favor in the principal central stations of the country. The headquarters of the company are in the Monadnock building, Chicago.

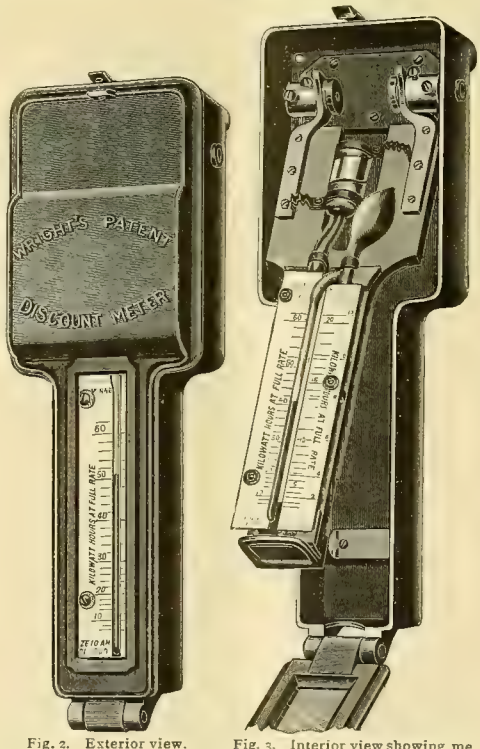
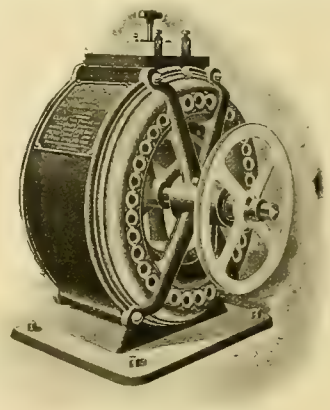


Fig. 2. Exterior view. Fig. 3. Interior view showing meter tipped for resetting.

WRIGHT DISCOUNT METER.

Laboratory Motor.

The cut shows the appearance of a special slow-speed laboratory motor made by the Emerson Electric Manufacturing company of St. Louis. This motor was designed in response to a general demand for an alternating-current motor giving more power than can be obtained from the ordinary small sizes of induction motor and less than the regular alternating-current power motors of half horse power and upwards. It is especially intended for use on plate-glass machines, dental work, small pumps and similar uses. Its extremely low speed gives it quite a strong torque at the pulley and makes it much more convenient to arrange for direct belting or gearing without the intervention of countershafts.



LABORATORY MOTOR.

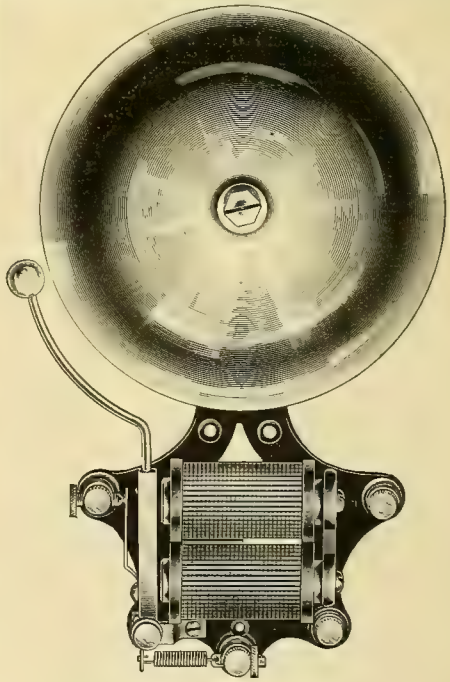
Straightline Iron Frame Bell.

This bell, which is represented herewith, the makers say, has all the good features of the best bell now on the market, such as cast bell-metal gongs, platinum contacts, etc., and, aside from these, every part which enters into the makeup has been improved in design and construction. The gongs are cast with a square hole, and instead of setting on top of the flat post, are forced over a square standard and fastened in place by a heavy hexagon steel-cap screw, making it impossible for the gong to turn or loosen. The frames are so designed that it is never necessary to remove the gong in order to put up the bell, as the screw holes are always exposed. The back of the frame is hollowed out so that it bears on the edge, thus adapting itself to the slight irregularities of a plastered wall, and at the same time making it impossible for it to loosen, or the connecting screws to come in contact with the wall.

The magnet cores, instead of being butted up against the japan of the back armature, as is usual, and held in place by a screw only, have a shoulder cut on them and are forced into a counter-sunk seat in the back armature, which gives a perfect magnetic connection for the full cross-section of the core and renders it absolutely impossible to loosen.

The armature is pivoted in perfect 60° adjustable cone bearings with steel trunnions and brass cones, giving a wearing surface which would last a lifetime without readjusting.

The contact spring, instead of being riveted to the armature, is set in and fastened in such a way that it is impossible for it to loosen. Yet, in case the platinum-contact rivet burns out, a new one can be substituted in a few seconds without removing the bell from the wall.



STRAIGHTLINE IRON FRAME BELL.

All the other parts of the bell are brought to the same degree of perfection. The full line of bells will consist of 10 movements and about 40 sizes. Each movement has its own special tools, jigs, etc., and the maker's guarantee to replace, free of charge, any part in any movement found defective or worn out within two years, and the maker will guarantee the duplicated part will not vary a thousandth part o fan inch from size of the original.

Special tools and improved methods of manufacturing permit the Proctor-Raymond Manufacturing company of Buffalo, which makes these bells, to

furnish them to the trade at the same price now asked for inferior articles.

Armour & Co.'s Power Plant at the Stockyards.

A large central power plant is building at the Union Stockyards for Armour & Co. who some time ago came to the decision to concentrate the power generation for their diversified manufacturing plants at the yards into one central power station with electrical transmission to the points of consumption. The plant required will be of exceptional size, approximating, it is said, 10,000 horse power when the plans are fully carried out, and the investment will be large, but the saving will be enormous, making a much more profitable return on the money spent than could be obtained in any other way.

Electricity is already used quite extensively in the Armour packing-houses and factories for light and power; but the greater part of the power is transmitted by belts and shafting from scattered plants. Now all the old steam plants will be discarded, all power generation being concentrated in a central power house especially erected for the purpose. There will be very little belting or shafting in any of the buildings, and the power will be produced and transmitted to electric motors and electric lamps on the most economical scale. An idea of the economies that will be effected may be gained from the statement that the 12 large water-tube boiler units forming the first installment of the new plant will replace 92 smaller boilers, many of them old and comparatively inefficient, with a corresponding number of attendants. Similar savings will be made in engine and dynamo operation; in place of, say, 25 engine rooms, there will be one. The wires from the power plant to the various factory buildings will be laid underground.

Wickes Brothers of Saginaw, Mich., will supply boilers for the new plant to the extent of about 4,500 horse power. Their contract calls for 12 vertical water-tube boilers of 375 horse power each. These boilers occupy a ground space of 12 by 18 feet each and are 36 feet high.

Three engines have been ordered—all of the cross-compound, condensing, slow-speed, Corliss type. One, of about 2,000 horse power capacity, will be built by the Bass Foundry and Machine Works of Fort Wayne, Ind.; the other two, rated at about 1,100 horse power each, will be turned out in the shops of the Filer & Stowell company of Milwaukee.

The power generators will be directly connected to two engines. There will be three of them—one 800 kilowatt, 500-volt machine driven at 85 revolutions per minute, and two of 500 kilowatts each, operated at 90 revolutions. These generator will be of the type made by the Walker company. Alternating-current dynamos will be used to supply current for lighting. There will be three of these also, and they will be furnished by the Warren Electric Manufacturing company of Sandusky, Ohio. One will have 7,000 lights capacity (16 candle power lamps) and two will be of 3,600 lights capacity each. These alternators will be single-phase machines operated at 7,200 alternations. The generators and lighting dynamos were sold through J. Holt Gates & Co. of Chicago.

Electric motors of a combined capacity of about 1,200 horse power are used in the works now, and they will be largely used in the new plant, although other motors will be needed. All of the existing engines and dynamos will be discarded.

J. E. Smith is the chief engineer for Armour & Co., and James P. Malia is the electrician. Pierce & Richardson are the consulting engineers.

It is believed that the other stockyards companies will follow Armour & Co.'s example.

Death of John W. Keely.

John W. Keely, whose name has been familiar to the public for a quarter of a century as the inventor and promoter of the mysterious "Keely motor," died at his home in Philadelphia on November 18th. Mr. Keely was 71 years old and a carpenter by trade. His "motor" came into prominence in 1874, and during the succeeding years he induced several wealthy persons to invest in it without clearly knowing what it was. Mr. Keely claimed to have discovered a physical force hitherto unknown. But he was so secretive and mysterious about his "invention" and his workshop that his claims were generally derided and he was denounced as a charlatan. Yet he always had a few followers who supplied him with funds to be used in perfecting the "invention." Personally, he was well liked, and there are many who regret his death beside those financially interested in his work. Mr. Keely's lawyer is reported to have said that immediately before Mr. Keely was taken ill arrangements had been completed for taking out patents on the "motor." All the necessary information is available, and the attorney said that the patents will probably be applied for in the course of the next few months.

Trouble in Omaha.

A Chicago newspaper has the news that the first demonstration by the Anti-crowding Car society of Omaha was made about 6 p. m. on November 18th. On one car the first information the conductor received was a stern command from a dozen members of the society:

"Let another man or woman get on this car and over you go. Ring the bell and go ahead if you don't want trouble."

The conductor took one look at the scowling faces of the men jammed into the aisle of the street car, so the story runs, and then hastily gave the signal to move on, leaving a crowd of angry people at the crossing.

The society belongs to Walnut Hill, a fashionable suburb of the city, and is the outgrowth of what the residents of that locality term a long siege of crowded car service.

Finally, the residents of that section at a mass meeting formed the Anti-Crowding Car association, the members of which pledged themselves to resist by force any effort to crowd more than a comfortable number into the cars when any of the members are present.

If the company does not improve the service the society will go to the courts, it is said, to see if it is legal for more people to be taken on a car than can find seats.

American Street Railway Association.

Secretary Penington has distributed the report of the seventeenth annual meeting of the American Street Railway association, which was held in Boston in September. This document is a valuable addition to the records of the association and contains the papers and discussions that occupied the members at the Boston convention. President Lang's portrait and a view of Bunker Hill monument are presented in this volume. A list of members of the association is also given and the report of the committee on "Memorials of Deceased Members" is included. The proceedings comprise a volume of 255 pages, which is a creditable publication. Secretary Penington should be commended for the promptness with which this work is completed every year.

Copies of the report of the committee on "Standard Rules and Regulations for the Guidance and Government of Employes" have been distributed among the members of the American Street Railway association by the secretary. This report had not been completed when the last meeting of the association was held, and it was deemed advisable to distribute copies of it, so that members could consider it carefully and be prepared to discuss it and act upon it intelligently. In presenting its recommendations the committee says:

So far as possible it has been the aim of your committee to suggest only such rules as are applicable to the largest number of street-railway systems, and which experience has shown to be of value. No attempt has been made to suggest rules especially applicable to street railways operated by horse or cable power, as roads of this class are few in number and rapidly passing out of existence.

Minor details of punishment for neglect of duty or infraction of rules are likewise omitted, as these are largely controlled by local conditions. We would suggest, however, that punishment involving suspension from duty be made as infrequent as is consistent with good discipline.

Careful examination has been made of a large number of rule books of various railway companies, and such features as seemed most desirable have been to some extent included in this report.

No especial claim is made for originality and no attempt has been made at elegant phraseology. It has been the aim of the committee to state all rules in a clear and explicit manner and to include only those which are essential.

The report deals first with general requirements, general rules and a general notice to employes. Special instructions are submitted for depot masters, receivers and inspectors, and general rules for conductors and motormen are supplemented by special rules for each. The report is the work of practical men, and shows an intimate knowledge of the requirements of general service.

South American Notes.

Advices from Argentine Republic mention the probability of the street-railway system of Buenos Ayres undergoing a change in motive power by the substitution of electricity for horses. Already two electric lines are in operation, under direction of men from this country. There are numerous applications to construct electric railways, and in the transformation of the old and the building of new lines United States manufacturers have a good opportunity.

From Chile comes information that a syndicate, composed of English and German houses, is to take charge of the electric lighting of Santiago and of the electric railways in that city. Power will be taken from the river Maipo. About $6,188,000 is already invested in the enterprise, and work has already been commenced. There are a number of water-courses in Chile having a fall sufficient to develop electric power, which will doubtless be utilized in the development of national industry.

It is said that an electric street railway in Asuncion, Paraguay, would be remunerative; also that a field is presented for incandescent lights for stores and houses, and, as it is generally hot in that climate, there appears to be a good opening for the introduction of electric fans. A. F. T.

A Curious Proposal in Milwaukee.

Milwaukee advices are to the effect that the mayor of the city and a committee of the board of directors of the Milwaukee Electric Railway and Light company have reached a tentative agreement, by which the city will relinquish its efforts to secure four-cent fares in consideration of a lump sum, which will amount to $2,650,000 by 1924, the date of the expiration of the company's franchises. As a further consideration the city is to grant no competitive street-railway franchises before the the year named. It is said that the proposition does not meet with favor from the citizens, who figure that the company is getting the best of it, and that it is not likely to be ratified by the City Council.

Electrical Progress in Belgium.

The first trial of the electric-lighting plant for the Southern railroad station of the city of Brussels was made on July 22d and was pronounced as being thoroughly satisfactory. This work was performed by the Societe Anonyme d'Electricite of that city, and it has since received a contract from the government for the installation of a similar plant in the Southern station of Ghent.

The most important installation of electricity recently made in Brussels was in the king's palace, in which there will be a total of 7,500 lamps when the work is completed, and the larger number of these will be of five candle power each, especially those employed in the chandeliers for the illumination of the ball and reception rooms.

In the Brussels system there are about 47,391 lamps, reduced in units of 16 candles, averaging 117 lamps per 100 running meters of streets having the service. In this number are included 770 arc lamps and 28 electric motors, having a total of 105 horse power.

In view of the rapidly increasing use of electricity in Belgium there is said to be an opportunity for enterprising Americans to introduce electrical apparatus of all kinds.

Tesla and Job.

[From the Indianapolis Journal.]

When Job was asked, "Who hath divided a watercourse for the overflowing of waters, or a way for the lightning of thunder?" it is not recorded what answer was made; but if the same question were addressed to Nikola Tesla he would promptly reply, "I, Lord." And to the query, "Canst thou send lightnings, that they may go and say unto thee, 'Here we are?'" he would answer: "Yea, verily, that can I." But Job, it must be remembered, was a modest man.

CORRESPONDENCE.

New York Notes.

New York, November 21.—On Saturday the commission appointed by President McKinley to revise the patent and trademark laws of the United States held its first session in this city in the Federal building, having held a hearing in Chicago last month. Francis Forbes of this city, who is chairman of the commission, and A. P. Greeley, assistant-commissioner of patents, were present, but Judge P. S. Grosscup of Chicago was detained in that city and did not arrive in time to attend the session. He is expected to-day. Several lawyers and business men expressed their views and further discussion is expected.

From Porto Rico comes the news that the First Regiment of Engineers has left Ponce on the transport Minnewaska on its way home. Many electrical men are serving in this regiment.

There was a public hearing last week in the borough hall in Brooklyn to consider the combination trolley cars on the Nassau road. There has been a deluge of protests against the winter use of these cars. Edward M. Grout presided, and many of the aldermen and councilmen of the borough were on hand. More than a score of letters from indignant citizens were read, and in all of them the cars were described as ill-ventilated, unhealthy and dangerous. Henry Yonge appeared on behalf of the company, and contended that the objections to the cars were ill-founded, and that the passengers would soon come to see their good points. At the close of the hearing the councilmen present adopted a resolution authorizing President Grout to prepare an ordinance to be presented to the Municipal Assembly, prohibiting the use of the combination cars between October 1st and May 1st.

The Sun has a long account of an X-ray party, "the latest fad in Brooklyn." I have been puzzled by the reported statement of the man giving the show: "My X-ray plant is attached to a static battery, an eight-plate machine." The faddists in Brooklyn must have taken up a new kind of battery as well as a new form of entertainment.

The electric-railway development of New Jersey is proceeding apace. Trolley cars began to run on the North Hudson County Railway company's Grove street line from Jersey City to Hoboken last week, and in a few days the last horse-car line in Hudson County will have become a thing of the past. The trolley line extends south only as far as Grove street and Newark avenue, and, until arrangements have been made with the North Jersey Street Railway company to run cars over its line from that point to the ferry, passengers will be transferred to the terminus by horse cars. Arrangements have been made with the town of Irvington so that the New York and Newark trolley line will be extended through to Hilton and connect with the line to Maplewood. The probabilities are that within a few months the road will be continued to Milburn, which is less than two miles from Maplewood. Following that may come an extension to Short Hills, and perhaps to Madison and Morristown.

The project is all in the scheme of the North Jersey company. Maplewood and Hilton are now reached by a roundabout trolley trip through South Orange upon a line built by the South Orange and Newark company, which was recently absorbed by the North Jersey company.

H. B. Coho & Co., dealers in electrical supplies, formerly at No. 30 Cortlandt street, convened a meeting of their creditors on Friday at No. 143 Liberty street, about 75 per cent. of the debts being represented. The liabilities are $60,000 and the assets are estimated at $40,000. A committee of five creditors was appointed to wind up the affairs of the concern, collect outstanding accounts and divide the proceeds pro rata.

The membership of the New York Electrical society continues to increase, and that organization starts in the season with unusually fair prospects. At the last meeting 25 applications for membership were favorably acted upon.

The New York Central and Hudson River Railroad company is experimenting with motors to draw its trains through the long subway leading from the Grand Central station. The use of steam engines in the tunnel will be discontinued if a satisfactory substitute, minus smoke, cinders and soot, is found. Electric motors should fill the bill, but it is said that no decision has been reached. M. S.

Northwestern Notations.

Minneapolis, November 19.—The street-railway employes of Superior, Wis., have formed a union and will affiliate with the Amalgamated Association of Street Railway Employes.

The Sheboygan Electric Light, Power and Railway company is arranging to improve its service materially. The car service will be faster and more frequent.

George A. Steel, owner of the East Side electric railway, between Portland, Ore., and Oregon City, has gone into bankruptcy. The cause is his endeavor to support with his own fortune this enterprise.

Work is progressing well on the new grade for the electric line from Sioux City, Ia., to Leeds. It is expected to have cars running on the new route by December 1st.

J. D. Trenholme, formerly of Bathgate, N. D., and others have invested $75,000 in an electric-light plant in Dawson City. The entire capacity of the plant has been taken by two or three dance halls, lights being paid for at the rate of $1 each per night. The plant is to be enlarged.

The Houghton, Mich., Council has indicated its willingness to grant a franchise for an electric line from Calumet to Houghton, provided the promoters can secure the permission of the other towns interested, within six months.

The Snoqualmie Falls Power company was the lowest bidder for furnishing street lights for a portion of Seattle, Wash., at $7 per month. The Union Electric company was the lowest for the entire city, at $8.80 per month per light.

Additions to the equipment of the electric-light plant of Fergus Falls, Minn., are being made which will bring its capacity up to 3,500 16 candle power lights.

J. R. Harrigan has been appointed superintendent of the electric-car lines in Eau Claire, Wis., and Chippewa Falls for the Chippewa Valley Electric Railway company.

The Glencoe Electric Light company of Glencoe, Minn., has been incorporated with $8,000 capital stock. Its plant is expected to be in by December 15th.

The Citizens' Traction company of Oshkosh, Wis., has tested its electric heaters for keeping its street cars warm. The heaters are an unbounded success. The cost of maintenance is said to be greater than stoves, but they are much more satisfactory. The estimated cost is placed at one additional ton of coal a day for the 12 cars in use. The company has recently made changes in its schedule, and placed more cars in service.

The street-car company and the city of Oskaloosa, Ia., have locked horns on the matter of an extension to the fair grounds. The company desires to put in pine stringers and a light flat rail, while the city insists on a heavy rail and oak stringers, as required by the ordinance.

The Waterloo and Cedar Falls Rapid Transit company has completed rebuilding the line in Cedar Falls, Ia., and has the extension in operation.

The Chippewa Valley Electric Railway company has won another round with the Wisconsin Central Railway company over the crossing near Chippewa Falls, Wis. The steam-railroad company secured an order to show cause why the crossing should not be taken out and an interlocking switch put in. The court overruled the motion at the hearing.

The Big Timber Electric Light and Power company of Big Timber, Mont., has put in a new 65 horse power engine, to be sure of power when the water power becomes uncertain on account of ice. Norman Irvine, while employed at the plant, was pouring some babbitt metal into a bearing, when an explosion occurred and threw the molten metal into Irvine's face. It was thought his eyesight was ruined, but it was not, though it will be some time before he can use it.

Wolf Egersderfer has settled his suit out of court against the Mankato (Minn.) Gas and Electric Light company for injuries received in coming in contact with a live wire.

Winnebago City, Minn., has let the contract to the Fort Wayne corporation to furnish electric equipment for a lighting plant, and to the Twin City Iron Works of Minneapolis for a steam plant.

The council of St. Cloud, Minn., has given the street-railway company permission to lay rails to the new depot of the Great Northern Railway, and work has been begun.

The first monthly settlement of the municipal electric-light plant of Madison, Minn., shows earnings collected of $203.

The council of Winona, Minn., is considering an ordinance requiring the city engineer to inspect all electrical apparatus.

The council of Green Bay, Wis., has contracted with the Green Bay Gas and Electric Light company to furnish street lighting for 10 years at a much reduced rate. The contract also gives the city an option on the plant at the expiration of the 10 years.

The electric-light plant at Whitehall, Mont., has been completed and put in operation.

The council of Mt. Pleasant, Ia., recently decided to put in new dynamos for the electric-light plant. The mayor vetoed the contract on the ground that the city was not in need of the new machinery and the desired equipment could be secured cheaper than the price at which the contract was let.

The City Council of Des Moines, Ia., has passed a resolution directing the Board of Public Works to rescind its action requiring the street-railway to pay taxes for seven feet of the paving on Ninth street and substituting five feet.

In the case of the city of Little Falls, Minn., against the Little Falls Electric and Water company, the Supreme Court of Minnesota holds that a 30-year contract is an unreasonable length of time and beyond the power of the council to bind the city.

The little town of Cass Lake, Minn., which is only about 90 days old, will soon boast of electric lights. The Glenmount Lumber company is building a saw mill and will put in an electric-light plant, from which the streets and business places will be lighted.

The Hughes Electric company's new plant in Fargo, N. D., has been completed and was recently on exhibition to the public. The company is about to make a proposition to furnish city lighting, if the council will annul its present contract. The proposition will be at a much less figure than the present contract. C.

Canadian Intelligence.

Ottawa, November 18.—Mr. James A. Bell, C. E., has been instructed by the City Council of St. Thomas, Ont., to make a report to the council upon the cost of installing a municipal electric-lighting plant.

At a special meeting of the Orillia, Ont., Town Council, Mr. R. J. Parke, E. E., of Toronto, was appointed to prepare specifications for the proposed Ragged Rapids water-power scheme.

The Cataract Power company of Hamilton, Ont., has connected its transformers with the Hamilton city wires of the Hamilton Electric Light and Power company, and the incandescent lights were supplied with electricity developed at Decew's Fall, which is about 34 miles distant from the city.

An important question is to come up at the next meeting of the Hull Electric company of the city of Hull, opposite Ottawa, in Quebec province. A project is on foot to alter the cars now in use, so that they can be run at 40 miles an hour. By doing this, less cars will, it is calculated, be required, and therefore less men will be employed.

Mr. W. C. McDonald, the millionaire tobacco manufacturer of Montreal and the generous benefactor of McGill University of that city, has again demonstrated the interest he takes in that institution of learning, by presenting to the department of electrical engineering, in charge of Professor R. B. Owens, late of Lincoln, Neb., the sum of $30,000 with which to purchase the best and most modern electrical apparatus. This gift will enable the department to acquire much-needed apparatus, and it is said that, when all is in place, the department will take first rank among the many departments of electrical engineering on this continent.

The Toronto Street Railway company is considering a scheme for a system of radial electrical roads to run out of Toronto through the province of Ontario. The matter has been before the company's board in an informal way for some time, but a meeting was held recently to see if some practical scheme could not be evolved. The assembling in Toronto of many well-known capitalists identified with electric-railway ventures lends color to the report. The party held a conference at the street-railway company's office, but the result of the meeting has been kept a profound secret. It is known that a scheme for an extension of the Toronto street-railway lines to the outlying suburban districts was under consideration, but there is an impression that something of greater moment is contemplated than the local radial extension.

It is confidently predicted that the valley of the St. Maurice River, which is now a densely wooded wilderness, will in 10 years be a hive of industry. Three immense enterprises are already at work—the Shawinigan Power company, Lawrentide Pulp company and the Canada Iron Furnace company. The first-named company is preparing to develop electric power in large quantities, available for industries which will follow, and for transmission to Montreal, Quebec and other manufacturing centers. The natural lay of the land and water is such that power can be developed at a minimum of cost. The company is proceeding to install a plant which will be able to develop 30,000 horse power, to be eventually increased to over 100,000 horse power. The engineers estimate that 200,000 horse power can be developed.

The statement of the Montreal Electric Street Railway company for the year shows the net profits to have been $601,704.18, against $507,885.60 for the year previous. After paying a 10 per cent. dividend $138,000 was carried over to the surplus account.

A by-law providing that the Toronto Electric Street Railway company shall have vestibules on the rear of its cars has gone into effect, but the vestibules are not to be seen, nor does there appear to have been any effort on the part of the company to provide them. The Toronto civic authorities are determined to test their power in the matter, and City Solicitor Caswell promptly laid information against the company for breach of the by-law. The case will come up for trial.

The new fender which will be used on the cars of the Ottawa Electric Street Railway company was successfully tested recently. The new fender comes from Providence, R. I., and all the cars will be equipped at a cost of over $5,000, or about $80 a car. The fender is about six inches from the rail and is so constructed that by the motorman touching a spring the appliance drops and picks up the object in front of it.

The official announcement has been made by the Quebec, Montmorency and Charlevois Electric Railway company that it is proposed to electrically equip the road running to Cap Tourmente, Que., and to construct an independent branch to Montmorency Falls. The estimated cost of improvements is given as $330,000, and when completed the system will comprise over 60 miles of electric railway. The president of the company is H. J. Beemer. The shareholders of the Quebec, Montmorency and Charlevois company and of the Quebec electric railway had their first general meeting on Wednesday last since the amalgamation of the companies, to authorize the board of directors to issue debentures to the amount of $1,500,000, bearing five per cent. interest, redeemable in 25 years, and secured by a first mortgage on all the properties of the company. Since the companies were amalgamated the gross receipts have been $79,006, and the expenses $33,647, leaving a net balance of $45,559.

The Electric Street Railway company of Toronto, Ont., has decided to make an experiment in the matter of smoking cars and will run cars on certani lines during certain hours of the day, in which smokers will be allowed full privileges.

An ordinance to provide $6,000 for the purchase of an electric-light plant for the town of Acton, Ont., has received the sanction of the taxpayers. Arrangements will be made immediately for the installation of the plant.

In the city of Halifax, Nova Scotia, a special committee has been obtaining information as to the advisability of the city undertaking its own street lighting, and, as a result, the city electrician and engineer have been instructed to prepare plans and invite bids for a suitable plant.

A startling offer for the supply of electric power to the city of Toronto, Ont., was among the bids received by the Board of Control of that city last week. A company offered to light the city streets and supply energy for manufacturing purposes at the rate of one cent per horse power per hour. Its capital, it states, will be $5,000,000, and when the dividends reach 10 per cent., it offers to light the streets at cost price. It will also establish a manufactory for electric supplies, and the profits of this will come under the same agreement.

Professor R. B. Owens, the new professor in charge of the electrical department of McGill University, Montreal, is introducing a new feature which will be of great value not only to the students, but will also confer great benefits upon the general public. This will be a standardizing laboratory. There will be a room devoted to high-potential machinery, where a voltage of 200,000 will be obtainable. W.

PERSONAL.

Mr. F. S. Terry of the Weston Electrical Instrument company of Newark was in Chicago last week calling on several of his old friends.

William E. Hale, a Chicago capitalist and a large owner of the stock of the Toledo Traction company, died at his home in this city on November 16th. He was the father of George E. Hale, professor of astronomy in the University of Chicago.

At the meeting of the corporation of Yale University on November 17th the resignation of Professor George J. Brush, who has held a professorship in the Sheffield Scientific School since 1855, was presented. By a vote of the corporation he was appointed professor emeritus. Professor Brush having previously declined a re-election to the post of director of the Sheffield School, which he had held since the creation of that office in 1872, the selec-

tion of Professor R. H. Chittenden as director was confirmed.

Professor Sidney H. Short is about to sever his connection with the Walker company, of which he is vice-president and electrical engineer. His resignation will take effect on December 1st. Professor Short has labored continuously and successfully in the field of electrical invention for a number of years, and it is believed that rest is the chief feature of his plans for the immediate future. Dr. Short—for the title of LL. D. was conferred upon him recently by his alma mater, the Ohio State University—is a prolific inventor and has played a conspicuous part in the development of the electric railway.

NEW INCORPORATIONS.

The Fort George and Eleventh Avenue Railroad company of New York, which is a consolidation of the North End Street Railway company, the Fort George and Eleventh Avenue Railroad company and the Fort George Extension Railway company, was incorporated on November 21st at Albany, with a capital of $3,000,000. The directors are John T. Little, Jr., Ambrose F. McCabe, Fred C. Garrick, Frank F. Ogston and Sharon Graham of New York, Clement McCumming of Yonkers, Charles A. Gilbert of White Plains, William A. Dibbs of Brooklyn and D. C. Moorehead of Jamaica.

ELECTRIC LIGHTING.

Woodsfield, O., has voted to issue bonds for an electric-lighting plant, which will be installed at once. W. H. Pelton of Cleveland, O., is the electrical engineer in charge. Plans and specifications may be obtained from him, or from George P. Dorr, corporation clerk, Woodsfield, O.

There is a keen competition in Yokohama among manufacturers of electric lamps. German lamps of 16 candle power, guaranteed for 1,000 hours, have been offered for 12 cents each, while other lamps of similar quality are quoted at about 16 cents each. This competition is not expected to be of long duration.

A Trenton, N. J., dispatch of November 20th states that General James F. Rusling and a number of other shareholders of the Trenton Light and Power company at a conference decided to bring suit against James Moses, the president of the company, to have a decree made declaring $100,000 which Moses received from the sale of 2,500 shares of common stock to belong to the shareholders. They say that the stock was held in trust for the stockholders. Moses says that the stock was his own, and in this is supported by several of the stockholders.

From Philadelphia comes the statement that a deal to consolidate three electric-light plants in Baltimore—the Brush, Edison and Northern companies—is being arranged. A banking house is said to have secured options on the bonds and stocks of the Baltimore companies. The three concerns are capitalized jointly at $2,899,000, and their total issue of bonds amounts to $1,874,000. The plan is to deposit these securities in trust as security for an issue of $4,000,000 five per cent. 30-year collateral trust and mortgage bonds of the consolidated company, to be additionally secured by a mortgage on all the property and plants.

ELECTRIC RAILWAYS.

It is reported that an American syndicate has secured the concession for the building of an electric-street railway in Tampico, Mexico.

Allis engines and General Electric generators will be installed in the addition to the Metropolitan West Side Elevated Railway company's plant in Chicago. There will be two new generators of 1,600 kilowatts capacity each.

The quarterly report of the Buffalo and Niagara Falls Electric Railway company shows: Gross earnings of $61,040.06; operating expenses, $22,327.56; net earnings, $38,712.50; other income, $468.85; gross income, $39,181.35; fixed charges, $27,372.97; net income, $11,808.38.

The first quarterly report of the Buffalo and Lockport Railway company has been filed. It is for the quarter ended September 30th. It shows: Gross earnings, $13,686.39; operating expenses, $6,258.18; net earnings, $7,428.21; other income, $25; gross income, $7,453.21; fixed charges, $5,555.04; net income, $1,898.17.

As the result of an action taken by the Old Colony Trust company of Boston, trustee of the Seneca Electric Light and Power company's bonds, the plant of that concern in Seneca Falls and Waterloo, N. Y., has been placed in the hands of H. H. Crowell of Syracuse, who is appointed receiver for the company.

The Supreme Court of Missouri has decided that the Julian law, enacted by the Legislature in 1894, and providing for the sale of public franchises to the highest bidder, is unconstitutional. The case came to the Supreme Court on application of the Attorney-General of Missouri for a writ of mandamus to forfeit the charter of the West Side Electric Street Railway company of Kansas City for violation of this law. The court denied the writ, holding the law to be vague and indefinite.

TELEGRAPH.

The Birmingham Post says that an agreement has been arranged with the Congo Free State, allowing the survey of an African transcontinental telegraph line along the western shores of Lakes Tanganyika and Albert Edward.

An English technical journal reports that the telegraph line from Cairo to the Cape of Good Hope is proceeding favorably from both ends. The north end has already reached Omdurman. Mr. Molum's party is just about ready to start to construct the line from Tanganyika to Stanley Falls on the Upper Congo. Mr. Cavendish is carrying the line northward through the northern territory of the Chartered company, and the two latter portions of the great line will meet within the next two years.

Preparations are being made by the Signal Corps to erect several hundred miles of telegraph line in Cuba for the use of the army of occupation. At present telegraph facilities on the island are meager, and regiments which might be removed from the different headquarters would have difficulty in communicating with their commanding officers. Two companies of the Signal Corps have already been sent with the command which will be located at Nuevitas, these being fully equipped with material to construct 100 miles of telegraph line. The same number of signal men will be sent with each corps, and they will construct whatever lines may be found necessary for the convenience of the army. Puerto Principe, which will be occupied by American troops in a short time, is located 60 miles from the coast and is not in telegraphic communication with the outside world. The signal men will immediately begin the construction of a line to one of the coast cities, so as to obviate the necessity of sending a messenger when the officer in command there desires to communicate with his superior. Material for the construction of 500 miles of telegraph line has been sent to Savannah, which point will be made a base of supply for the Signal Corps.

PUBLICATIONS.

The Hoppes Manufacturing company of Springfield, Ohio, has just issued a fine catalogue describing its steam separators and oil eliminators.

The Julius Andrae & Sons company, Milwaukee, Wis., is distributing a comprehensive catalogue treating particularly of its line of telephones.

An indication of the prominence which electric carriages are assuming is found in the fact that the Electric Storage Battery company of Philadelphia has issued a pamphlet devoted to the special types of chloride accumulators designed for electric vehicles. Cells of special construction have been exclusively adopted and are extensively used by the Electric Vehicle company in operating the electric cab and livery business in New York, and also by the Pope Manufacturing company of Hartford in numerous types of automobiles. Results have been satisfactory in these applications and have demonstrated, it is claimed, that electric vehicles are commercially successful and economical in operation.

ELECTRICAL SECURITIES.

General McNulta, as receiver of the National Bank of Illinois and of the Calumet Electric Railway company, has filed a report in the United States Circuit Court, giving an itemized statement of the receipts and disbursements of the Calumet Railway company between May 1, 1897, and August 31, 1898. The total receipts are $503,475, while the disbursements were $492,938.86. The receipts from operation were $281,786.39. The cost of operation and expenses was $297,409. On the credit side is included an item of $195,000, representing the receiver's certificates issued by order of the court. The certificates were issued in order that the National Bank of Illinois might be reimbursed for money which it advanced to the railway company. These certificates bear six per cent. interest yearly and are payable on or before June 1, 1900.

MISCELLANEOUS.

B. F. Lamborn, city clerk of Alameda, Cal., desires catalogues and trade publications from electrical manufacturing companies.

It is announced that the Niagara Falls Power company has just closed a contract and lease with the Electric Lead Reduction company, whereby the latter company will occupy the two-story frame building formerly occupied by the Chemical Construction company on the power company's lands, and will also take a considerable block of power for the operation of the plant. As the name of the company signifies, it will engage in manufacturing by an electro-chemical process. It is understood that Philadelphia capital is interested in the company, and that the industry is destined to become one of the most important at Niagara Falls.

In electrical matters Germany holds a leading place among the nations of Europe. According to a recent compilation, Germany has 711 miles of electric railways, equal to those of all the rest of Europe together. England is credited with only 98 miles. Most of the larger towns of Germany have electric lines, and the whole system of Berlin will, by the year 1901, be converted to electricity. The old prevails in England that all that comes from Germany is cheap and bad, but a short tour through the chief manufacturing districts of Germany discloses the fact that the Germans are in possession of some of the finest machinery in the world, and that they know how to use it.

It is announced by the Niagara Falls Power company that on November 21st it closed a contract with the Union Carbide company for 15,000 electrical horse power, which power is to be used in a fine new carbide plant to be at once built on the power company's lands. The present plant will be continued in operation, and the new works will be erected on a new site, north of the New York Central and Erie tracks, near the Niagara Junction railway trestle. The buildings will occupy a large space and are likely to be built of brick. One of the new buildings will be over 800 feet long and two stories in height. The cables for carrying the current from the power house to the new works will be laid in underground conduit. The new plant will have connection with Buffalo avenue by a new road to be constructed by the power company, while the Niagara Falls Waterworks company will at once lay a main to the site. As stated, work on the new plant will commence very soon, in order that it may be ready for the current next summer, for that is the time the contract calls for its delivery. This contract for 15,000 electrical horse power means the product of three of the immense power producers in the central station of the Niagara Falls Power company.

TRADE NEWS.

Wickes Bros., the Saginaw (Mich.) boiler makers, have opened a Chicago office at 1214 Marquette building. W. S. Huyette, formerly of Milwaukee, is in charge.

The Illinois Electric company announces that its sales on Crefeld weatherproof, magnet, office and annunciator wires are increasing every month. The company also states that it carries one of the largest and most complete stock of wires of any concern in Chicago.

The Westinghouse Electric and Manufacturing company is about to move its Chicago office from the seventh to the twelfth floor of the New York Life building at LaSalle and Monroe streets. The new offices will be larger and better arranged than the old ones and adjacent to the new quarters of Westinghouse, Church, Kerr & Co.

The Western Electrical Supply company of St. Louis, Mo., is putting on the market this season the Monarch lamp. This is the sixth season this lamp has been before the public. The company reports that this lamp has been kept constantly up to date and every effort has been made to furnish a lamp that fulfils the wants of station managers.

J. M. Atkinson of Chicago, through his attorneys, Brown & Darby, has notified several makers of rail-bonds that they are infringing patents owned by him and granted to Budd J. Jones on December 31, 1895, and March 2, 1897. These patents cover the principle of the laminated-loop rail-bond with which Mr. Atkinson's name is so prominently identified.

The Marks Enclosed Arc Light company of New York announces that it has secured another injunction, this time against the Electric Construction and Supply company, Fred A. Kinsman and Charles E. Rocap, in the United States Circuit Court for the Southern District of New York, Judge Lacombe issuing the decree. The injunction is based upon United States patent No. 520,996 for improvements in arc lamps.

According to Associated Press reports contracts amounting to several hundred thousand dollars have been recently secured by the Westinghouse company from England for electric-railway apparatus for use by the Hull, Halifax, Bradford and Norwich tramway companies. The company has also made contracts for electric generators for the cities of Norwich, Coventry and Plymouth, it is said. These contracts are for 262 electric railway motors and eight generators.

The Central Electric company is making great preparations for the usual holiday trade in miniature lamps for decorative purposes. It is carrying large stocks of these lamps in clear and natural colors, in all candle powers and voltages. It is also introducing a new type of standard-base miniature lamp operative upon circuits of 90 to 130 volts. The small dimensions of this lamp render it particularly adapted to sign work or almost all kinds of decorative purposes.

L. W. Collins, well known in electrical circles, has been appointed western representative for the Merritt Electric company, Middleton, Mass., with headquarters in the Boylston building, Chicago. Mr.

Collins is favorably known in electrical circles through his connection with the electrical press and later as a manufacturer and dealer. The Merritt Electric company, as is well known, manufactures incandescent lamps and makes a specialty of renewing lamps. With so energetic a representative as Mr. Collins, it is confidently expected that the demand for the Merritt lamps, especially throughout the West, will be largely increased.

The Cleveland Electric Trading company reports that it has been enjoying a prosperous fall trade, in both new and second-hand apparatus. Its shipments of machinery have extended from Connecticut to California, and from Northern Minnesota to Texas. The company handles second-hand goods of high grade on consignment or it will purchase direct, if desired. It has been having a splendid run on alternating apparatus, arc-light machinery and lamps. The company is arranging to increase its capacity, both in repairs and second-hand goods, and hopes to enter upon the new year with a factory of its own which will be well fitted for handling all classes of electrical work cheaply and successfully.

The Stewart Electrical company of Cincinnati, O., is now under a new management. Mr. E. W. Mullikin, for many years identified with prominent manufacturing interests of Ohio, lately as president of the American Laundry Machinery company and now treasurer of the Campbell Manufacturing company, has purchased the entire business of the company. However, Mr. John A. Stewart, well known to the electrical fraternity, is still associated with the company. Mr. W. E. Campbell, the new manager of the shops, although still a young man, has had a large practical acquaintance in the management of factories. The company has experienced managers and ample capital and gives promise of success.

BUSINESS.

The business formerly conducted by the Orne Electric Construction company will be continued by the Chicago Electric company at 111 and 113 West Harrison street, Chicago. Orders will be filled promptly. The company manufactures telephones and electrical specialties, and contracts for all kinds of electrical construction and repair work.

Send four cents (in stamps) for an illustrated booklet issued by the Chicago, Milwaukee and St. Paul Railway company, operating the direct route across the American continent to the new transpacific possessions of the United States. The booklet is full of latest reliable information and valuable for reference. It can be used as a textbook in school. Address George H. Heafford, general passenger and ticket agent, Chicago, Ill.

The Central Electric company is introducing a new type of shade holder called the "Ideal," which is indeed ideal in many respects, its advantages being that it is made from one piece of metal and so constructed that it will not get out of shape, the common fault with most types of shade holders. The company has a variety of all kinds of portable reading and desk lights. The peculiar adaptation of these types of lamps to so many different purposes has led to a wide variety of types that are adapted to nearly all conditions. These and many other useful articles will be fully illustrated in the new catalogue which is about ready for distribution.

The season for Christmas decorations is always a busy one for the contractor and electric-light station manager, as nearly all Christmas decoration now means some kind of special electrical illumination. The Packard sign lamp is designed with a view of meeting the demand for a lamp of uniform candle power, voltage and efficiency for this class of work, and it is now very extensively used for decorative purposes. The Packard sign lamp is a miniature lamp of two candle power to be used in connection with a regular Edison candelabra receptacle, and of a proper voltage to burn four in series on from 50 to 60 volts, and eight in series on from 100 to 120 volts. It is guaranteed to possess long life and high efficiency. The Electric Appliance company of Chicago carries these lamps and receptacles in stock at all times, but carries a specially large stock at this season of the year to meet the unusual demand.

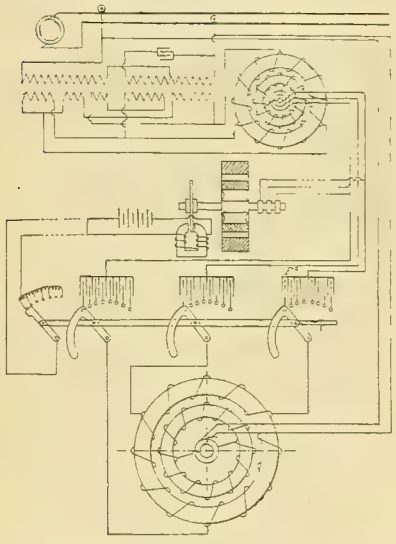
Sometime ago the Warren Electric and Specialty company of Warren, Ohio, organized a contest for the choice of a name for its new lamp. The judges have just rendered a decision and the following is a list of those persons who were awarded prizes, and the names suggested by them: First prize, $50 (Peerless), Joseph E. Calloway, Pueblo, Colo.; John C. Watson, Charlotte, N. C.; J. W. Freeman, Joplin, Mo.; second prize, $30 (Wesco), K. W. Mansfield, South Norwalk, Conn.; Gugler Electric company, Minneapolis, Minn.; J. E. Calloway, Pueblo, Colo.; H. P. Ayer, Portland, Me.; J. S. Daily, Chillicothe, Ill.; New Orleans Electric company, New Orleans, La.; C. J. Wetsel, Chicopee Falls, Mass.; third prize, $20 (Liberty), W. H. Schott, Chicago, Ill.; Joseph E. Calloway, Pueblo, Colo.; A. D. Scatcherd, Batavia, N. Y.; Chas. Frankish, Ontario, Cal.; Phillip Hickley, Chicago, Ill.; fourth prize, $10 (Aladdin), Thomas Day company, San Francisco, Cal.; (Aurora), D. A. Gill, Kansas City, Mo.; (Eclipse), Lemuel K. Cushing, Chicago, Ill.; (Encore), H. L. Brintnall, Saginaw, E. S., Mich.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 15, 1898

614,076. Alternating-current Motor and Mode of Operating Same. Charles S. Bradley, Avon, N. Y. Application filed June 22, 1896.

The method of converting electrical energy into mechanical motion consists in converting a single-phase alternating current into polyphase currents, varying the rate of the currents, charging a rotary magnetic field therewith, and charging a co-operating independently movable motor element within the field with the single-phase currents.



NO. 614,076.

614,082. Intermittent Electric-surface Conductor. Franz Burger, Fort Wayne, Ind. Application filed July 23, 1897.

An intermittent electric surface conductor is described, comprising a stringer mounted on the cross-ties, a feeding conductor supported on the stringer, a flexible covering for the conductor secured to the stringer and having a series of contact pieces extending through the covering, channel irons arranged on each side of the flexible covering and secured to the stringer, leaving a slot between their adjacent edges, and insulating material applied to the adjacent edges whereby, when the trolley-wheel passes through the slot, the contact pieces are pressed into engagement with the feeding conductor and rise therefrom by the resiliency of the covering.

614,124. Electric-switch Mechanism for Electric Railways. John M. Murphy, Torrington, Conn. Application filed September 3, 1897.

An electro-magnetic switch mechanism comprises electromagnets, an armature switch, a main-line circuit having contacts adapted to be engaged and closed by the shifting of the armature switch, a local circuit for energizing the magnets to throw the switch, the local circuit having a contact member continuously held in engagement with the switch during its vibrating movement.

614,161. Electric-car Truck. Edward Cliff, Newark, N. J. Application filed August 24, 1898.

In a car truck the side frames comprise the upper and lower bars, and the parallel transom beams at their ends are secured between and to the upper and lower bars, combined with the channel-beam bolster, whose edge flanges pass downward between the transom beams, and the springs suspended by links from the side frames and receiving the ends of the bolster.

614,190. Magnetic Chuck. Oakley S. Walker, Worcester, Mass. Application filed March 11, 1897.

An outer magnetic pole is constructed to receive detachable bushings or pole pieces of various sizes; an inner magnetic pole is constructed to receive pole pieces of various diameters, and a series of detachable pole pieces constructed to be mounted upon the magnetic chuck for holding annular pieces of work of varying internal and external diameters.

614,207. Telephone-exchange System. William E. M. Jackson, Chicago, Ill. Application filed January 14, 1896.

A strip of spring-jacks comprising an anterior insulating block, longitudinal sections of metal tubes set two in each of a series of circular holes in the anterior block, a posterior insulating block with terminal springs set therein resting in contact one with each of projecting ends of the tube sections, and securing strips to hold the two insulating blocks rigidly in position.

614,225. Electric Meter. Ludwig Gutmann, Peoria, Ill. Application filed December 4, 1897.

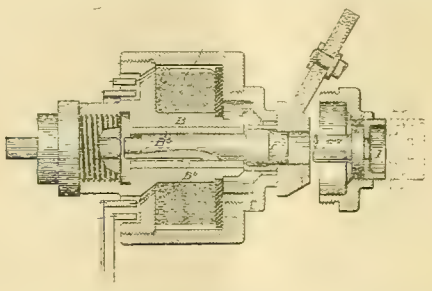
A feature of this instrument is an armature consisting of two parallel endless conductors, conducting strips uniting the endless conductors, strips being angularly disposed relatively to the endless conductors, and a rotatable shaft upon which the conductors are mounted.

614,228. Method of Charging Secondary Batteries. Cyprien O. Mailloux, New York, N. Y. Application filed April 24, 1891.

The method of charging secondary batteries consists in producing progressive changes of supplemental electromotive force acting with an electromotive force in the circuit of the battery, and in accordance with and progressively graduated to the progress of the charge and increases of counter electromotive force in the battery.

614,270. Insulated Supporter for Electric or Other Wires. Charles K. King and George A. Mead, Mansfield, Ohio. Application filed June 29, 1898.

A clamp or ear, a hanger body including an insulator-washer, a threaded studbolt mounted therein and adapted to be screwed into the clamp, and a lock-washer interposed between the insulator-washer and clamp, are features of this device.



NO. 614,190.

614,275. Apparatus for Heating and Agitating Air. Edwin F. Porter, Boston, Mass. Application filed December 27, 1897.

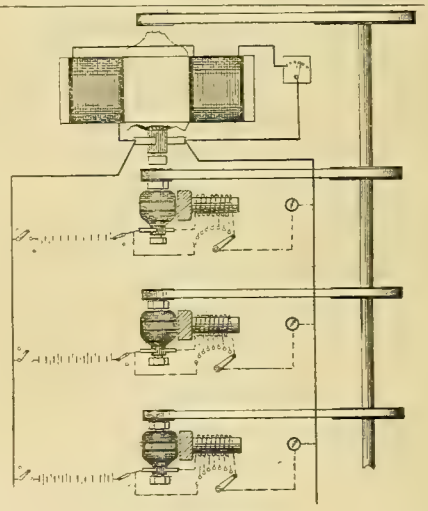
A series of plates is employed and means provided for electrically heating them as well as means for equalizing the distance between the plates, and mechanism for moving the plates relatively to each other to agitate the surrounding air.

614,321. Trolley Controller. John Dolan, Dayton, Ohio. Application filed April 23, 1898.

Provision is made for pulling the rope down when the trolley jumps the wire, and a pull-cord provided at its upper end with a yoke carrying a roller, the rope passing through the yoke whereby a downward pull on the cord restores the rope to its normal position after being pulled down.

614,373. Arrangement for Exciting Magnets of Dynamo Machines. Max Déri, Vienna, Austria-Hungary. Application filed July 27, 1898.

A dynamo machine having field magnets, the iron of which is equally distributed around and equidistant from the armature, with two groups of excitation coils, one of the two windings exciting a field having a contrary direction to that of the armature field and being in unchanged series connection with the armature, while the other winding effects the main excitation and is in a shunt circuit, so that the fields excited commonly by the groups of windings added to the armature field form a field constant or nearly constant in strength and direction.



NO. 614,228.

614,394. Starting Resistance for Alternating current Motors. Ernst L. K. F. Kahlenberg, Berlin, Germany. Application filed December 30, 1897.

The method of motor control consists in supplying an alternating-current motor with an actuating current, directing the current to the separate motor circuits through corresponding groups of controlling resistance, and asymmetrically altering the divisions of the several groups of resistance connected with the separate motor circuits, whereby the operative condition of the motor is changed.

614,404. Signaling Apparatus. Morris Martin, Malden, Mass. Application filed September 28, 1885.

A series of signal-indicating instruments is arranged in independent branches and a circuit-controlling device forming a part of each, which in one condition retains the corresponding branch open and in the other condition closed; combined with a single receiving instrument in the main circuit connected with all the branches, having a movement synchronous with that of the indicating instrument and arrested by the circuit-controlling device of the indicating instrument when it arrives at its normal position.

614,412. Electric Switch-operating Mechanism for Railways. Louis E. Walkins, Springfield, Mass. Application filed September 7, 1898.

In an electric switch-operating mechanism for railways, there is claimed the combination with the switch-tongue of an electric motor, a bar adapted to be moved by the motor and connected to the switch-tongue, a source of electrical energy and normally open-circuit conductors fed thereby, and adapted to cause, when closed, the running of the motor, means for closing the circuit, a catch device for engaging the motor-shifted bar, and electrical devices for releasing the catch device.

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Niagara Commissioners and Power Development.

By Orrin E. Dunlap.

The commissioners of the state reservation at Niagara took a very important step at a recent meeting held in their office at Niagara Falls, departing from a policy which they have closely followed throughout the period of power development. It has been told in these columns from time to time how the commissioners have displayed their opposition to the use of the water of the upper Niagara for power purposes and how they have persistently declined to avail themselves of their right to use, free of charge, water and electricity for light and power purposes, under chapter 513 of the laws of 1892, which provides that, on request of the commissioners, the Niagara Falls Power company shall furnish the reservation electricity for light and power purposes, also water, free of charge. Former boards of commissioners have not availed themselves of this right because of fear that such a step would establish closer relations between the state of New York and the Niagara Falls Power company, and that it might be construed as a tacit agreement which might affect the legal standing of the commission later on.

The present board has determined to avail itself of the privileges under the statute and use the power and water for the benefit of the property intrusted to its care. Accordingly, at a meeting of the commissioners, held at the Falls on November 16th, which was attended by Chairman Green, Commissioners Porter, Dow and Kingsford, Commissioner Porter introduced a resolution providing that the commissioners proceed to secure the light, power and water that is their right under the law referred to. In introducing this resolution Commissioner Porter announced that the attorney-general of the state had assured him that the commissioners would not be establishing relations between the state and the company in a closer degree and that it would relinquish none of its rights, but that, as the Legislature had provided for a supply of electricity and water, it was clearly the duty of the commissioners to avail themselves of it. This view of the question met the approval of the board, the resolution was adopted, and the Niagara Falls Power company will be requested to furnish the electric and water supply of the free park.

This action of the commissioners is significant, and it is hailed with satisfaction as meaning much for the welfare of the power development at Niagara. The action of the board will allow of the water and light service at the park being very materially extended. The application of electric power to the inclined railway will add to the revenue of the park, and will be a material improvement. Before the installation for the operation of the inclined railway by electricity can be put in, it is probable that an appropriation will have to be secured from the state at this winter's session of the Legislature. The Niagara Falls Power company has always been ready to furnish the necessary electricity and water provided for by the law, and has only been deterred from doing so by the opposition of the commissioners.

Another important action by the commissioners at the same meeting was the adoption of a resolution changing the name of Bath Island to Green Island, in recognition of the faithful services of the Hon. Andrew H. Green, who, ever since the free park was established, has been chairman of the board. Green Island is the second largest island in the possessions of the state at Niagara. It lies between the mainland and Goat Island, and was named Bath Island originally, owing to the location of bath houses there in former days. This action on the part of the commissioners will receive general approval; in fact, anything tending to honor the eminent chairman of the commission or show appreciation for the great service he has performed would be indorsed by the people.

At the conclusion of this important meeting the commissioners decided to signalize the day on which they had taken these important actions, and they accordingly stepped from their office to the upper edge of Green Island and had taken the picture which is reproduced on this page. In the group are Chairman Green, Commissioners Porter, Dow and Kingsford, Secretary-treasurer Gregory and Superintendent Thomas V. Welch. The group comprises a body of men who believe in the industrial future of Niagara, and who do not purpose placing anything in the way of advancement, while they recognize the necessity of preserving the picturesque and imposing natural scenery.

Commissioner Dow. Chairman Green. Secretary Gregory.
Commissioner Kingsford. Commissioner Porter. Superintendent Welch.

NIAGARA COMMISSIONERS AND POWER DEVELOPMENT.

American Electrotherapeutic Association.

The new officers of the American Electrotherapeutic association are: President, Dr. Francis B. Bishop, Washington, D. C.; first vice-president, Dr. Ernest Wende, Buffalo, N. Y.; second vice-president, Dr. W. H. White, Boston, Mass.; secretary, Dr. John Gerin, Auburn, N. Y.; treasurer, Dr. Richard J. Nunn, Savannah, Ga.; executive council, Dr. Robert Newman of New York, Dr. G. Betton Massey of Philadelphia, Dr. A. D. Rockwell of New York, Dr. William J. Morton of New York, Dr. Charles R. Dickson of Toronto, Dr. Frederick Schavoir of Stamford, Conn. Next year's meeting of the association will be held in Washington, D. C., on September 19th, 20th and 21st.

The City Council of The Dalles, Ore., has passed over the veto of Mayor Nolan an ordinance providing for lighting the streets with electricity.

Legislation Affecting Electrical Interests Recommended.

It may be an unfortunate coincidence but it is, nevertheless, significant that the report of the Illinois state board of railroad and warehouse commissioners, asking for more authority and a broader scope, should be submitted while the investigation into the official conduct of the last commissioners is being conducted in the criminal court of Chicago. The board recommended that laws be passed giving it jurisdiction over the street railways, sleeping-car, telegraph, telephone and express companies. The report also recommends the enactment of a law which will put the stockyards companies under its full control, and it also declares that the commission should be vested by law with discretionary power to pass upon the advisability of the construction of any new roads, in order that mercenary speculators can be prevented from preying upon the credulity of the public by placing upon the market bonds issued for the construction of railroads which can never pay operating expenses. Among the recommendations for legislation made by the report are the following:

"We would recommend that a law be enacted which will require the railroads to place electric bells at grade highway crossings to give warning to those who may approach the crossing of the coming train; that these bells shall be placed at such crossings as in the judgment of the commission shall be necessary, and where, in the judgment of the commission, such bells are not sufficient the law shall provide that such other devices shall be used as shall, in the discretion of the board, be practicable. We would recommend further that whenever a new highway crossing is to be constructed across a railroad the law shall provide that the railroad commission shall determine the manner, mode and place of such highway crossing. We would recommend that the commission be given full authority to prescribe the place where and the manner in which all railroad crossings shall be made, and that one railroad shall not be permitted to cross another in this state without the consent of the commission.

"We recommend that a law be passed placing the street railways under the jurisdiction of the commission, and that this commission be empowered to order interlocking systems at the crossings of street-railway and steam-railway lines and be given full authority to specify the place, manner and mode of crossing of all street railways that shall be built in the future. Street-railway lines should be required to make reports to the commission for the purpose of protecting the investing public.

"We firmly believe that in a state so completely covered with a network of railroads laws should be passed placing entirely in the hands of the commission the discretionary power to pass upon the advisability of the construction of any new road, thereby preventing the mercenary speculator from preying upon the credulity of the public by placing upon the market bonds issued for the construction of a railroad which can never even pay its operating expenses.

"We recommend that telegraph, telephone and express companies be required to make a report of their gross and net earnings to this board, and that a law be passed placing them as absolutely under the control of this commission in all respects as the railroads in this state now are."

Properly constituted, a board or commission might

give splendid service to the public and to corporations performing public service if the recommendations were adopted, but in the present state of politics in Illinois any legislation looking toward the enlargement of the powers of the railroad and warehouse commission will certainly provoke serious opposition.

High-voltage Power Transmission.

By Chas. F. Scott.

Part II.

Some measurements upon the line were made by determining the power to the raising transformers when the lines were connected and when they were disconnected. These measurements showed that the loss due to the line is small below 45,000 volts, but increases rapidly when about 50,000 volts is exceeded, and reached 16.4 kilowatts at 59,000 volts. The results up to 52,000 volts are given in curve 2, Fig. 9. Curve 1 in this figure is the loss on the same circuit, measured a year later by a different observer, using a different method. At the maximum loss shown there is a difference of only eight or nine per cent. in electromotive force for the same loss on the two curves.

The record of the operation of this line at 50,000 volts for over a month is of very great interest, as it is a practical demonstration of the feasibility of operating a line at 50,000 volts, a pressure four or five times as great as any which had been in general commercial use. Mr. V. G. Converse had been up to this time closely associated with this work. He had much to do with the design and construction of the high-tension transformers and insulators, tests upon losses in lines made at the Pittsburg laboratory and the tests at Telluride.

Measurements at Telluride.

The work at Telluride was then taken up by R. D. Mershon. The facilities for experimental work

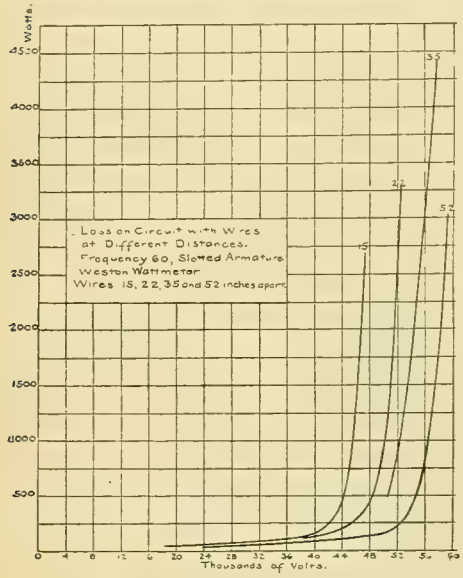

FIG. 6. HIGH-VOLTAGE POWER TRANSMISSION.

were increased and instruments were provided for carrying on the tests. Mr. Mershon found peculiar difficulties in making exact measurements of the power to the circuit. A wattmeter in the low-tension circuit of the raising transformer led to errors under the conditions which prevailed. Some very able and painstaking work was displayed in detecting the error and overcoming it with the facilities at hand—and the facilities were none too plenty in the heart of the Rocky Mountains for making measurements which would tax the resources of almost any laboratory. The apparatus used introduced a disturbing influence in the circuit, which, however, could be measured and eliminated. On the other hand, a wattmeter for measuring power on a high-tension circuit must accommodate a very high voltage and a very small current. As the charging current to an open line is usually very large in proportion to the loss current, the error of the instrument is very sensitive to slight variations of phase in the shunt current. A description of the instruments and the methods used are given in an extract from the report of Mr. Mershon, which will be found at the end of this paper in Appendix A. The results of the measurements and the conclusions are given partly by extracts from Mr. Mershon's report and partly in abstract.

Results of Measurements.

The results of measurements taken are embodied in curves.

In every case the measurements were taken upon an open-circuited line—in no case upon a line which was transmitting power. The line losses obtained are, therefore, a combination of those occurring between the line wires and the very small I^2R loss in the wire itself due to the charging current of the line

Measurements taken with the Weston wattmeter include the loss in the high-tension coil of the power transformer due to the currents applied to the line. This loss is in general small and in the following curves corrections have not been made for it. Curves taken with the Thomson wattmeter require no such correction.

There is an additional correction which may be made in the case of those curves whose voltages were obtained from the raising transformer. This correction arises from the fact that the action of the capacity current taken by the line in connection with the series reactance of the transformer supplying it is such as to make the voltage impressed upon the line somewhat greater than that obtained by the ratio of the transformer winding. The measurements taken to determine the amount of the error in voltage show it to be small.

There were two generators used. One was that regularly running and supplying power to the power circuits of the Telluride Power Transmission company. It is a 600-kilowatt, 22-pole, quarter-phase machine, delivering 500 volts at a frequency of 60, or 7,200 alternations per minute. Its armature is of the slotted type and is wound with copper bars. In the notes this generator is designated as "slotted armature."

The other generator is one whose field is that of the 100 kilowatt toothed armature machine, originally sent out as a part of the first Gold King transmission plant. It has twelve poles and as originally run operated at 3,000 volts and 10,000 alternations. There are two armatures for this machine; a surface wound armature, designated as "smooth armature," and a toothed armature, designated as "toothed armature."

Comparison between Insulators.—A set of measurements was made for comparing the loss on the three circuits supplied respectively with large glass, small glass and porcelain insulators. The curves are very nearly identical and correspond very closely with the right-hand curve in Fig. 6.

There was a heavy, wet snow on the ground and the cross-arms at the generating station and more or less snow all along the line; that at the further end being drier than at the generating station. There was more or less snow falling during the measurements, and this accounts for a wide variation of the points taken at the high voltages, as falling snow renders the wattmeter reading very unsteady, the unsteadiness being such as one might expect if from time to time there was a discharge between the wires. This unsteadiness does not seem to be as great in the case of falling rain as in the case of falling snow.

Loss and Distance between Wires.—A series of measurements was made to determine the connection between the loss and the distance between wires.

As at that time it had not been fully demonstrated that the loss was not affected by weather conditions except there was precipitation, changes in distance between wires were made upon one circuit, while the distance between wires on another circuit was maintained always the same, and the latter was used as a reference circuit when a change in loss was obdinate.

The several curves have been plotted together, due correction being made for the slight difference in the loss in the reference circuit, which probably resulted from slight differences in the precipitation when the curves were taken. The distance between the wires in the several tests was 15, 22, 35 and 52 inches respectively. The results are shown in Fig. 6. It will be noted that the loss is much greater when the wires are close together and that the curve begins to ascend at a lower voltage.

Comparison of Wattmeters.—The loss curves in Fig. 7 were taken on one of the circuits, first, with the Weston wattmeter and then with the Thomson wattmeter. The Weston wattmeter was not in circuit when the measurements with the Thomson wattmeter were taken. As an additional check, the readings were taken on each of the wattmeters of the loss occurring in the shunt resistance; of the Thomson wattmeter the results were in practical agreement with each other and with those obtained by calculation. The discrepancy in the results obtained on the two instruments when measuring line loss will be referred to later.

Loss on Insulators.—A set of comparative readings was taken on one of the circuits and on a dummy circuit identical with the main circuit, as regards kind and number of insulators and the size of wire, but only 60 instead of 11,720 feet in length. The results show that the loss on the two circuits is practically identical up to about 50,000 volts, which is the part of the curve below the bend. The losses agree closely with those shown in Fig. 6. At higher voltages the loss on the dummy circuit increased slightly, indicating that the loss was of the same nature as that at a lower voltage. The agreement of the loss on the two lines at low voltage (i. e., below the bend in the loss curve) indicates that this loss was over the insulators. The great increase in loss on the long line at high voltage indicates that the loss was due, not to the insulator, but to the line.

Resistance and Reactance in the Circuit.—Measurements were made with resistances between the generator and the raising transformer, then with reactance and then with neither resistance nor reactance. The results are shown in Fig. 8, and indicate a different condition, depending upon the character of the circuit supplying the current. It was presumed that this difference arose from a modification of wave form of the electromotive force applied to the line.

Wave Form and Loss.—Measurements were made upon the wave form and the corresponding losses when different generators were used and different circuits were connected. In one test an armature giving nearly a sine wave was used which delivered current at 30 cycles. Measurements were made upon one circuit only, and then upon two circuits in multiple. The current and the loss are both given in Fig. 9. The wave form for no load and for both conditions of load are given in Fig. 10. The current taken by the two circuits in multiple is twice that to a single circuit. The variation from a straight line in one of the current curves is due to a change in wave form as the voltage is increased. The loss for the two circuits in multiple is about twice as great as for one circuit at low voltages, but it is less than that for one circuit at high voltages. Referring now to the wave form taken at high voltage, it is seen that the wave form for the two circuits in multiple has a lower maximum than that for one circuit alone. The reduced loss on the two circuits is undoubtedly due to the different wave form when both circuits were connected. The distortion of the wave form is due to the reaction which the leading current produces in the generator and transforming apparatus.

Wave forms were also taken on the slotted armature giving 60 cycles. The wave forms are given in Fig. 11. The conditions are similar to those just described, in that a single circuit produces a wave having a much higher maximum than that produced when two circuits are run in multiple. The losses (which are not shown) bear the same general relation as that in the last case, namely, the loss with two circuits is greater at lo wvoltage and at the high voltage is less than on a single circuit.

A wave form was taken upon the toothed armature, both at no load and also when supplying current to one of the circuits. These are shown on Fig. 12. This wave differs radically from a sine wave at no load and is greatly distorted when supplying a leading current. In the no-load wave the value of the fundamental is 72.5 per cent.; the third harmonic 21.6 per cent.; the fifth harmonic 4.8 per cent. The

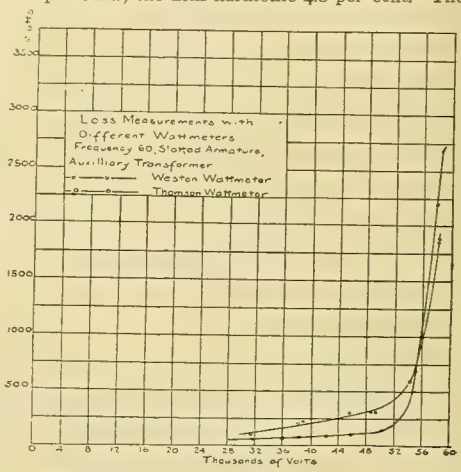

FIG. 7. HIGH-VOLTAGE POWER TRANSMISSION.

corresponding loss is given in curve 1, Fig. 9. The distorted wave makes the Thomson wattmeter read too high, especially at the lower electromotive forces.

Other Observations and Tests.

A series of observations was taken extending over a period of 33 days, to determine whether there was any connection between the loss occurring on the lines and the variations in weather conditions. Three readings were taken each day. They were, in addition to the wattmeter readings, readings for barometric pressure, temperature, humidity, wind direction and wind velocity. The weather observations were taken simultaneously at Ames and the King, using sets of weather instruments furnished by the United States Weather Bureau. The range of these observations is shown in a table given below, in which maximum and minimum refer to the maximum and minimum results obtained at any time during the 33 days over which the measurements extended:

Location.		Barometer.	Temperature Deg F.	Humidity per cent.	Wind velocity miles per hour.
Ames.	Maximum.	22.19"	73.5	43.2	22
	Minimum.	21 68"	56.3	7.1	2
King.	Maximum.	21.82"	62.0	42.5	20
	Minimum.	19.81"	47.8	3.0	3

If there was any variation in the loss on the lines for this range of weather conditions, it was so small as to be inappreciable. The results of all measurements taken during this work seem to

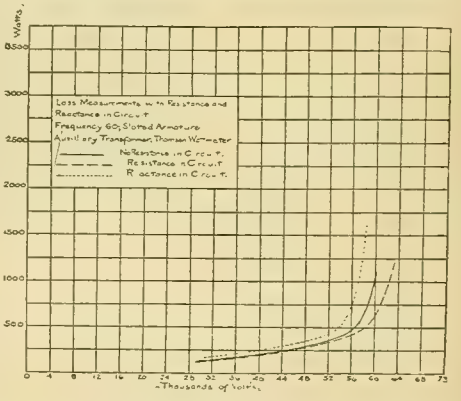

FIG. 8. HIGH-VOLTAGE POWER TRANSMISSION.

confirm the fact that the only weather condition whatsoever which affects the loss to any practical extent is that of precipitation. The loss seems to bear some relation to the size of the particles precipitated, being greater for a fall of snow in which the flakes are large than one in which the flakes are small.

In the power transformers used, the series reactance was comparatively small because of the subdivision of the coils. A change in the condition on the line as regards loss occurred when the Weston wattmeter was placed in circuit. This was detected by measurement upon the Thomson wattmeter, both when the Weston wattmeter was in circuit and when it was not. Moreover, the lines hissed when the voltage is 55,500 and the Weston wattmeter is out of circuit, but when the Weston wattmeter is thrown into circuit the hissing ceases, although the voltage rises to 57,700. The hissing sound is a characteristic of high voltage lines and begins at the bend in the loss curves. It always accompanies luminosity of the lines.

Along with this change there was another phenomenon not previously mentioned. This was a discharge which took place from time to time between the terminals of individual choke-coils. The discharge would occur sometimes between the terminals of one choke-coil and sometimes simultaneously on two or three of the choke-coils. These discharges made considerable noise, sounding very much like a pistol shot, and could be heard at a considerable distance from the transformer house.

As the choke-coil terminals are distant from each other about 8¼", it is not thought that this discharge took place through the air, but over the surface of the wood enclosing the choke-coil. The discharge, however, left no mark on this surface. Simultaneous with these choke-coil discharges one could hear, if standing under the line some little distance from the transformer house, a slight snap which seemed to be a phenomenon rather of the whole line than of any particular spot in it. Sometimes there was a corresponding snap over the lightning arresters. As the lightning arresters make more or less noise at all voltages, this snap over them may have been present at all times, but in some cases not sufficiently well marked to be heard above the continued hissing of the lightning arresters.

After the preceding results had been obtained, the two power transformers were connected up with their high-tension windings in series, the point of connection between them being grounded, and with their low-tension windings in multiple. With this arrangement voltage was impressed on one of the circuits, power being supplied by the smooth armature at 7,200 alternations. The voltage was run by means of the machine field to 90,000.

As the power taken by the lines at this voltage overloaded the motor used to drive the generater, a span was cut out of the circuits at a little distance from the station, leaving about 500 feet of wire in them. The voltage was run up to 133,000 volts and held there for some minutes; but the current finally jumped from the outside terminal of each transformer to the iron, smashing the heavy glass tube with which these terminals were insulated.

Discussion of Results.

The following is taken from Mr. Mershon's discussion of the results of his tests:

There is evidently a certain critical voltage at which the loss occurring between wires begins to increase very rapidly; indeed, it seems as though there might be something of the nature of a polarization similar to that which occurs in the case of an electrolyte; that there is something of this nature in the case of air or other gases subjected to an electrostatic stress is well known, and it has been taken as an explanation of the fact, that in the experimental determination of sparking distances in air, a certain minimum potential is necessary to establish an arc, no matter how small be the sparking distance. Also, Varley has done some work on tubes containing gases. This work was done with a series of Daniell's cells yielding 300 to 400 volts. The voltage was impressed upon electrodes sealed into the tubes. He established the following facts: First, that each tube required a certain potential to leap across; second, that the passage for the current having been once established a lower potential was sufficient to continue the current; third, if the minimum potential which would maintain a current through the tube be P and the voltage varied to P plus 1, P plus 2, etc., to P plus N, the current will vary in strength as 1, 2, 3, etc., N; P always meaning the lowest value at which the current will continue, and is less than that at which the current starts.

If such a condition of affairs obtains in this case, the loss curves of the preceding sheets must be made up in two parts, one the loss over the insulators and cross-arms, the other the loss occurring through the air. The first part of the loss curve up to or near the point where the abrupt bend begins must be the loss over the insulators and cross-arms alone; beyond the point where such a bending occurs, the loss curve must be made up of a combination of the two losses referred to.

If the action which takes place in air is similar to that obtained by Varley, we might expect that both (1) the position of the critical bend on the loss curve and (2) the law which the loss follows above the bend would be affected by the form of the electromotive-force wave impressed upon the line, for the former (1) must depend, not upon the mean square of the voltage impressed upon the line, but upon the mean square of that portion of the electromotive-force wave which is above a certain critical voltage, and the latter (2) must depend upon the form of that portion of the electromotive-force wave above a certain critical voltage, because, as Varley shows, the minimum voltage at which this peculiar loss begins differs slightly from the minimum voltage at which it will continue after the action has been established. If it were not for the latter consideration it would be comparatively easy to determine the equation for such loss, at least in the case of a pure sine wave, and it might be that there is a sufficiently small difference between the voltage at which this loss will begin and the voltage at which it will discontinue for such an equation to hold practically. That the loss depends upon the maximum value, if not upon the form of the electromotive-force wave, is shown by several of the loss curves in connection with their corresponding wave forms. This is particularly

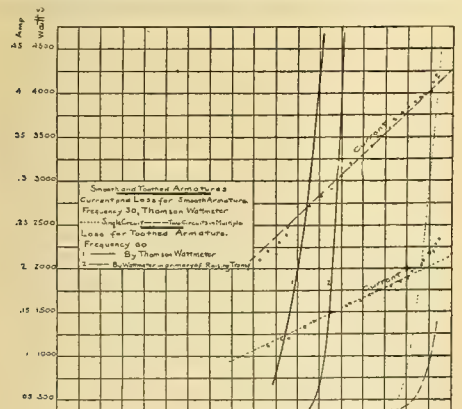

FIG. 9. HIGH-VOLTAGE POWER TRANSMISSION.

noticeable in one or two cases where the loss on two lines in multiple is less than that on one line, and although some of these comparisons will have to be made between curves taken on the two different wattmeters and are, therefore, not strictly comparable, they may be compared after such correction as is mentioned below in discussing the wattmeters In any case the curves are comparable, qualitatively, as regards the position of the critical point.

It might be objected that the results are rendered questionable by the curves in Fig. 7. The curves were taken under presumably similar conditions, except that one was obtained by means of the Thomson wattmeter and the other by means of the Weston wattmeter. This discrepancy is attributed to a charging current passing through the shunt resistance of the Thomson wattmeter. That the amount of capacity current necessary to produce the discrepancy is small appears upon the following considerations: In one case the loss obtained upon a circuit at 38,000 volts when using the Weston wattmeter is 90 watts, and under the same conditions, but using the Thomson wattmeter, the loss is 215 watts. The difference in the loss obtained by the two wattmeters is, therefore, 125 watts. The current is about 0.25 of an ampere. Now, 0.25 of an ampere, if in step with the electromotive force, would give on the Thomson wattmeter at 38,000 volts a reading of 9,500 watts; therefore the capacity current through the shunt resistance necessary to produce the discrepancy of 125 watts is 125 divided by 9,500, or about 1.3 per cent. of the current in the shunt resistance. The shunt resistance has a value of 1,202,300 ohms; at 38,000 volts the current through it would be about 0.032 amperes; 1.3 per cent. of this, or 0.00416 amperes, is that required to produce the discrepancy noted. In further support of this method of accounting for the discrepancy, the results obtained at different numbers of alternations, using the Thomson wattmeter, show a variation for different numbers of alternations of the losses below the bend in the loss curve, and which are thought to occur over insulators and cross-arms. There should be no variation in such loss for a variation in frequency.

Any discrepancy occuring in the Thomson wattmeter by reason of a capacity current in its shunt resistance will be affected to a greater or less extent by change in the wave form.

It is believed that all the phenomena connected with this work may be studied in a tube which has been partly exhausted. The work could then be done with comparatively low voltage and using direct current, which would much simplify the measurements. The contents of the tube might be partially rarefied air or other gas, as the action would undoubtedly be similar in all gases. With such a tube might be studied the law of variation in distance and form of electrodes, also in material and surface of the same.

Resume and Conclusions.

It is undoubtedly true that the loss is made up of a loss over insulators and a loss between wires, and that the latter is the only loss worth considering.

The loss between wires is not affected by any atmospheric conditions except precipitation. This statement, of course, must be taken as applying to such a climate as that in which the measurements were taken. The lines were seldom in fogs or clouds, and when they were, or when rain was falling, the moisture was of the purest. Near cities the loss would be undoubtedly much greater than that shown in these curves, because of the impurities both in solution in the moisture of the atmosphere and in suspension.

There will be for a given transmission a certain economical voltage, because while an increased voltage, with a given line wire, will reduce the loss in this wire by decreasing the transmission current, it will also increase the loss between the wires.

It is believed that attention to wave form is very important. The sine wave is undoubtedly the best as giving a stable form, and because of superior results with all kinds of apparatus. A flat wave would, of course, give less loss, but would not be stable, and as the nearest practical approach to a sine wave will not be perfectly stable but will still contain some harmonics, it will be of advantage to keep the series reactance of the transformers and generators as low as possible.

It is believed that 40,000 volts is perfectly conservative and safe as regards loss between wires for any ordinarily good wave form, and in a climate such as that in which the measurements were

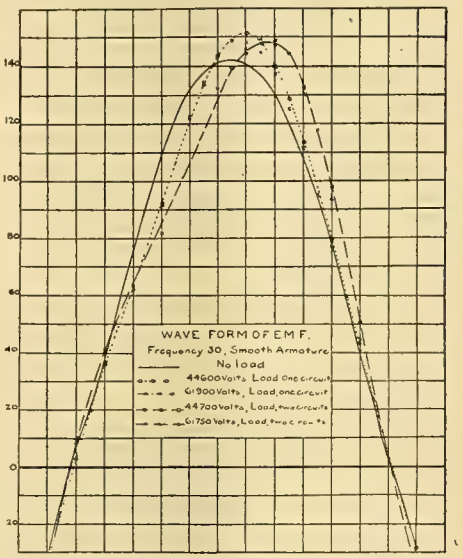

FIG. 10. HIGH-VOLTAGE POWER TRANSMISSION.

taken, i. e., where the air and precipitated moisture are practically pure, 40,000 volts comes well below the bend in the loss curve even under the worst weather conditions.

I can see no advantage of porcelain over glass, unless it be that of superior mechanical strength The latter is rather a doubtful advantage. The ball from a heavy caliber rifle or revolvers such as are used in the western country will smash any insulator, whether glass or porcelain. Porcelain offers a more tempting mark, being white. As to hygroscopic properties, no difference could be discovered so far as these measurements were concerned. It will make little difference under running conditions whether the insulator be hygroscopic or not, as the small amount of power necessary to keep the surfaces dry will be insignificant. I say under running conditions, because in starting up a "cold" line there is danger of breakdown if current is put on suddenly at full value, instead of being raised gradually. As far as the resistance to piercing is concerned, glass is just as good, practically at least, as porcelain. It needs no electrical test to pick out a good glass insulator, which is one advantage of glass over porcelain.

To sum up, glass insulators are cheaper, lighter, more easily tested and less likely to be shot at than porcelain; on the other hand, they have less mechanical strength.

In every case, in my experience, where a breakdown has occurred, it has been on a cross-arm which was "wind skaken" and "weather cracked," the current following the cracks. This leads to a curious result. The mark of the current will be on surface of the arm for five or six inches, then disappear from the surface altogether for some inches, then reappear, etc. On cutting open the arm one sees how the current has followed the best path, dodging in and out. Rain and moisture probably settle toward the cracks, carrying salts from the body and surface of the wood. This forms a path of low resistance, especially in wet weather. For this reason I have in the plant of the Colorado Electric Power company taken particular pains in treating both pins and cross-arms. The cross-arm treatment is such as fills all cracks and fissures, as a section of the wood shows.

This report would be incomplete without an acknowledgment of the assistance rendered in the work by the engineering force of the Telluride Power Transmission company, headed by Mr. P. N. Nunn. Especial credit should be given Mr. A. L. Woodhouse for his faithful work and constant perseverance in the face of great discouragement.

Press reports state that the Rochester and Lake Ontario Railway company (the Bay road), running between Rochester and Irondequoit, on Lake Ontario, a distance of six miles, will change its motive power from steam to electricity. This company runs three locomotives, nine passenger and a few freight cars. In 1893 it was leased in perpetuity to the Rochester and Irondequoit Railroad company, which company was leased for 10 years from April 15, 1898, to the Rochester Railway company.

Electric Moto-vehicle.[1]

By C. E Woods.

I would like to call attention to the fact that many names applied to self-propelled vehicles seem to me to be misnomers. Automobile is all right in France, and autocar is probably correct in England; neither of them, it seems to me, is wide enough in its application for America. Motocycle is misleading, as it throws the mind away from a carriage production, and horseless carriage is brutal, to say the least. Moto-vehicle, a term which I have used almost exclusively in my business, seems to be a name that covers the whole field of this work, as it implies

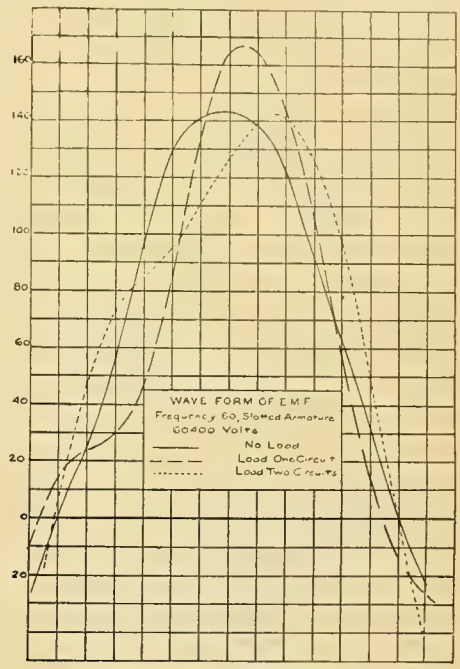

FIG. 11. HIGH-VOLTAGE POWER TRANSMISSION.

any form of motor power or any class of vehicle construction to which such power may be applied, and I sincerely trust to see its general adoption in the near future.

The development of the moto-vehicle has been an engineering proposition pure and simple, both in its electrical and mechanical phases, points in which have required the same careful consideration for operation, cost of production, adaptability and utility as all other engineering propositions of the day have required; and it is not, as many suppose, confined to the narrow realms of mere invention. The principles employed in the construction and operation of a moto-vehicle are units well known in all other classes of engineering work, and it has been an adaptation of already existing elements to a new purpose rather than the creation of anything new in its entirety for some specific purpose. In addition, the carriage-maker's art has had to be investigated, and the various styles, finish and contour used by it harmonized with a new condition of affairs in carriage building and designing. In this particular, I wish to express very briefly my experience of three years, and which has been gathered from all classes, in my efforts to locate and predicate a market for moto-vehicles.

The development of this is not confined, as many suppose, to the creation of one or two types of vehicles to which power may be applied with the idea that they would fill the requirements of the market. The cost of these vehicles necessarily demands solicitation for business from a class of people who have been users of fine carriages to some extent, and, unless they can have the same diversity of design, the same luxury of appointment and finish, and the same easy-riding carriage that they have been accustomed to, the proposition does not suffice to their wants and the market becomes limited. My work, and I notice that of others, is now toward the development and perfection of a general line of vehicles, rather than toward some one or two specific forms of so-called machines. As a general thing, the less the word "machine" is used in the market, the more satisfactory it is to the prospective purchaser, for he buys his carriage not because it goes without a horse, not because he wants conspicuousness or novel advertising on the street, but because he wants a carriage for himself or for himself and family in exactly the same sense that he has always purchased a carriage; and his first attraction to and admiration for a moto-vehicle is its independence of manipulation, its more rapid transit, and the refinement attendant to the use of such a vehicle by the absence of anything in the animal kingdom as a propelling power.

In the commercial world, its economy and utility are the prime factors for consideration, though at the present moment some considerable importance is attached to its value as an advertising medium,

1. Read before the Chicago Electrical association, November 18, 1898.

but this valuation is a very unstable affair and will have a very short life, while the real question with the merchant is the economy of using these vehicles as compared with already existing conditions. Unfortunately, experience of any magnitude in this direction has not, as yet, been acquired, although from present results some few figures can be fairly well estimated.

As one looks over the colossal achievements of engineers in the last 50 years and the industrial revolution which they have brought about, and then in connection with this thinks of the still undeveloped possibilities in all directions, it is very hard to think of the moto-vehicle and its future without at times indulging in a little speculation as to its ultimate value, the bearing it will have on domestic and commercial life, and whether its development, adaptation and application is to be in anything like the ratio that applied electrics have seen in the last 10 years.

Twenty thousand carriage-makers are required to-day to fill the market demands for vehicles in this country, as required for road and street transportation. A little over 30 per cent. of the total animal power used in this transportation is required in the cultivation of the soil, to obtain fuel for this power and to transport such means of maintenance and stable refuse from point to point. This means, broadly speaking, that animal power has in itself but about 70 per cent. efficiency in its application. Further, horse power cannot be worked at a greater average than about five hours or 20 miles per day, which, as compared with mechanical applications of any form, puts such power into a very low figure of utility. Under such conditions of operation, this power unit has a depreciation of not less than 20

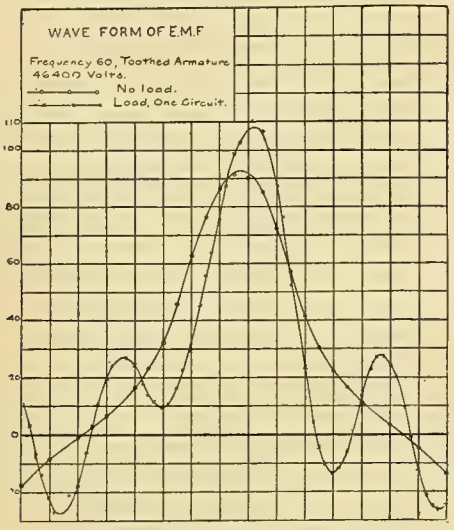

FIG. 12. HIGH-VOLTAGE POWER TRANSMISSION.

per cent. per annum, and from large users of horses in express companies, large liveries, etc., the depreciation has been given me as about 33 per cent.—either of which is far in excess of any good mechanical or electrical proposition of the day.

These startling facts and figures bring us very close to an understanding of the possibilities for the moto-vehicle as an industrial feature, and we cannot, under such circumstances, deny the brilliant outlook it has for the future. The sanitary conditions attendant to its use, its lesser cost of maintenance, its greater mileage capacity, its more rapid transit, its lesser space occupied in the stable and on the street, its freedom from expense when not in use, all put together, retires entirely the objections which at first appear as to its greater initial cost. The possibilities this vehicle opens up for road and street improvement and the low cost of maintenance should be items of great interest to municipalities, counties and states. Streets will have a capacity for double the amount of vehicles without any increased congestion; they will be freed from the continual pecking of iron feet, which is the main cause of their rapid deterioration, and sewers will perform their functions without being continually clogged up with refuse matter. With iron feet removed and rubber tires introduced exclusively, road and street construction should be reduced to one-half and maintenance to one-quarter of its present cost. By this, the possibility of building and maintaining a roadway across country, from city to city, on which only such vehicles, in connection with bicycles, will be allowed to run, is at once suggested, and the day will come when states and counties will be called upon to consider such roads. But to come back from speculation to reality. The greater first cost of these vehicles is a necessity which is very readily understood, as the vehicle part itself, for a first item, is necessarily more expensive, for the reason that when it comes to carrying twice or three times the weight of the vehicle ordinarily carried, to running it twice or three times as fast as the horse-drawn vehicle, under exactly the same conditions of road and street, it means quite a different proposition in vehicle construction, without reference to its electrical and mechanical features.

The necessity and durability of rubber tires for traction, noiselessness and protection to motors and batteries, goes unchallenged, as does the absolute necessity of reducing all friction losses by the introduction of either ball or roller bearings in all of the moving parts; all of which are much more costly than ordinary carriage construction, but by virtue of which depreciation is very much reduced over the ordinary vehicle and interchangeability made practical in all of the wearing parts. These conditions, coupled with the first cost of motors, batteries and accessories, will never put the selling price of the moto-vehicle on a par with a hundred-dollar buggy, as some people seem to imagine, but will put its durability far in excess of that vehicle.

In reviewing conditions in other directions that have led up to a possible perfection of the moto-vehicle, we can almost trace a sort of evolutionary wheel-within-a-wheel progress that has all the time been tending toward its development. Other means of conveyance than animal power, as by railroad, street car and bicycle, have given birth to a desire on the part of the public for any and all kinds of mechanical conveyance. With this came the perfection of rubber-tire application on vehicles, which were first used for their noiselessness, and which made possible the introduction of ball-bearing axles into carriage construction—two features without which the application of motor power would be almost prohibitive.

With the perfection of this came a gradual development of the moto-vehicle in its many phases, until to-day we have what can be pronounced a successful issue in its practicability, with an ever-increasing inquiry and demand from all over the world concerning its use and adaptability to personal and commercial wants.

This development, like all other propositions of kindred nature, was necessarily experimental in its initial steps, and unfortunately led to many premature and erroneous conclusions regarding possibilities in its use, and for a long time was not considered susceptible to any general application; and while with some people this first false impression has been retained, as a general thing its wide range of possible usefulness is well conceded, especially by the engineering fraternities of the country.

I remember in my first early experience the disappointments which arose in regard to weights, constructional features, controls, etc., and three years ago I thought it would never be possible to build a moto-vehicle with any mileage capacity at all at a less weight than 1,800 or 2,000 pounds, yet to-day I have vehicles in operation which weigh 800 pounds, including everything, and have a mileage capacity of about 28 miles on one charge of batteries. My work has also developed the fact that as great a range in different vehicles can be obtained as regards size and usefulness as in any of the prior lines of vehicles, and I have found that for a diversity of design, covering nearly 30 different styles of vehicles, the whole proposition is confined to what I call four different sizes of equipments. By this I mean four different sizes of motors, batteries and accessories, which are as follows:

My lightest vehicle is equipped with one 2¼ horse power motor, 36 batteries of 16-ampere-hour capacity for two hours, which run the vehicle at a speed of 14 miles per hour, carrying two people. The weights in all the construction work of this vehicle have been reduced to a minimum, the total weight of the batteries being 440 pounds, about 360 pounds being in the motor and vehicle proper. To tabulate these different equipments will be the most concise way of putting them:

No. 1 equipment—Passenger capacity, two; complete weight of vehicle, 800 pounds; weight of batteries, 440 pounds; average miles run on one battery charge, 20; speed, miles per hour: first, 3½; second, seven, third, 14; number of motors used on vehicle, one; horse power, 2¼; number of battery cells, 36; amperes per hour for three hours, 12; time in hours required to charge batteries, three.

No. 2 equipment, designed for a top carriage or a heavy buggy—Complete weight of vehicle, 1,150 pounds; weight of batteries, 600 pounds; average miles run on one charge, 25; speed, miles per hour: first, 3½; second, seven; third, 14; number of motors used on vehicle, two; horse power, three; number of battery cells, 40; amperes per hour for three hours, 18; time in hours required to charge batteries, three.

No. 3 equipment, designed for four passengers in an open vehicle, such as a trap or brake—Complete weight of vehicle, 1,800 pounds; weight of battery, 800 pounds; average miles run on one battery charge, 30; speed, miles per hour: first, 3½; second, seven; third, 14; number of motors used on vehicle, two; horse power, five; number of battery cells, 40; amperes per hour for three hours, 30; time in hours required to charge batteries, three.

No. 4 equipment, designed for both commercial delivery wagons and for heavy cabs and also applied to heavy carriages with tops—Passenger capacity for from four to eight people; complete weight of vehicle, 2,400 pounds; weight of batteries, 1,000 pounds; average miles run on one charge, 25; speed, miles per hour: first, three; second, six; third, 12; number of motors used on vehicle, two; horse power, 6½; number of battery cells, 40; time in hours required to charge batteries, three.

All of these equipments have been built by me and applied to different vehicles, and I regret that time did not allow me to get a condensed compilation of the tests, but I will give one of the large cabs, which will have to stand as a criterion for the rest.

The original calculation for the cab read as follows:

Maximum speed of vehicle, miles per hour, 12.
Total load to be carried, including four persons, 3,200 pounds.
Maximum horse power required in motors, 5½.
Average horse power required in motors, four.
Voltage of motors, 72.
Volts lost in transmission in motor, eight.
Maximum voltage required, 80.
Number of cells required at two volts each, 40.
Maximum amperes required, 52.
Maximum amperes per motor, 26.
Average amperes per motor, 22.
Mileage capacity desired at maximum speed, 30.
Hours' discharge required, 2½.
Ampere-hour capacity required in battery, 2½ hours' discharge, 110.
Greatest maximum effort required for overcoming inertia and grade climbing, nine.

In accordance with these calculations, from prior experience in smaller vehicles, I designed two motors of a nominal 3½ horse power each, either one of which was capable of running the vehicle at a slight overload under normal conditions of level roadway. The tests of the cabs showed on a macadam and asphalt road a very little difference and called, at a speed of 12 miles per hour, for 42 amperes, with a potential of 72 volts at the motor terminals, which amounts to practically four horse power. In overcoming inertia the amperes would rise with a slight drop of voltage to 65, gradually diminishing, until a speed of 12 miles per hour was

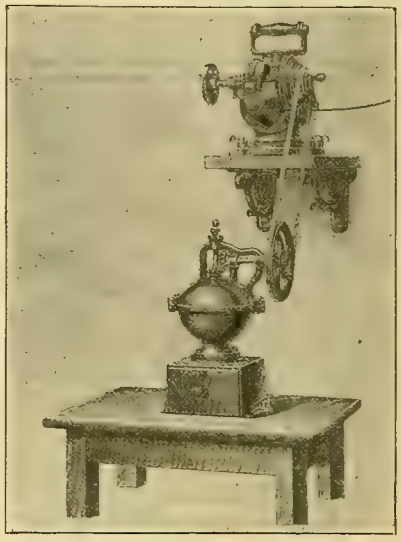

FIG. 4. ELECTRIC MOTORS IN GERMAN HOUSEHOLDS.

reached, which acceleration consumes a period of about one-half minute.

On these cabs a special instrument, combining both a voltmeter and an ammeter in one case, is used, and I am keeping a daily record of their performance under all conditions of roadway and weather. I find these vehicles adequate to all the conditions to which street traffic is ordinarily subjected.

There has been a great deal of controversy concerning the excessive weight of moto-vehicles, and also considerable controversy by some of our theorists about what is considered dead and pay weight, and I want to say here that this limitation has not as yet been reached in my experience. We are perforce obliged to have weight for traction purposes, and many tests made by me on slippery roads, bad places, etc., have proved that, with power applied to but two driving wheels, we could not reduce our weight more than about 15 per cent. to 18 per cent. of what I have already obtained it without being too light for good traction under all conditions of road.

I have also found a very great difference in amount of power consumed in the use of rubber tires. I recently tried a new tire on a cab which consumed about 18 per cent. more power than the ones I am regularly using. I also, by very careful tests, have discovered that the hard-rubber tire is far preferable to the pneumatic tire for use on moto-vehicles—and this without any reference to its first cost, durability or freedom from puncture. The facts of the case are that the pneumatic tire absorbs more energy by about 20 per cent. when inflated and by a very considerable increase when it ceases to be inflated to different points of pressure. My first attention was called to this by some tests made by Mr. Kimball of the C. P. Kimball Carriage company, and I afterward substantiated these tests myself in another direction, after which I confined all my designs to the use of wood wheels and hard-rubber tires.

The point of control has been a matter of considerable discussion by both those directly and indirectly interested in the development of the moto-vehicle. I have tried series-paralleling the fields,

and I have also tried series-paralleling the bateries, after which I have adopted exclusively the series-paralleling the batteries as my method of installation. The one thing to be observed is to have very large contacts and connections and to take the same pains in the distribution of the batteries when in parallel as one does in the distribution of current in the armature. In other words, a uniform resistance of the circuits of the different bat.eries will produce perfectly satisfactory results in their operation, which I do not find to be the case in series-paralleling the fields. This latter can be done to such an extent that but a small rise of current would be made in overcoming inertia, but the excessive amount of field winding will over-saturate the fields, unless they are unnecessarily large, and tends to a very considerable loss of voltage in dead resistance; and while we economize in current, we do not economize in energy, as in the case of series-paralleling the batteries.

Three speeds I have found to be sufficient for all practical purposes, even on our congested streets, and now have my motors running in parallel entirely independent from one another in their propelling function. Fourteen miles per hour, for the larger vehicles, I have found to be about the practical limit, as the amount of momentum stored up in the given weights of the vehicles cannot be brought under control by brake application quick enough to be safe on our city streets at greater speeds. In other words, we cannot brake on the moto-vehicle any more than we can on the car beyond the locking of the wheels. In the light road buggy which I have, I have geared it up to 20 miles an hour, and find that with 800 pounds I can handle it with a reasonable degree of safety on boulevards and parks, but I do not recommend these speeds to go any higher as a general proposition; although in racing I believe that the moto-vehicle will be brought down to 1½ minutes for a mile, or perhaps even less.

I regret very much that time will not permit me to go into the question of storage batteries for moto-vehicles, but as this has been a line of development confined entirely within itself for use on the vehicles rather than in the vehicle proper, I have not undertaken its diagnosis in this paper. I will say, however, that there are three different batteries on the market now which seem to be fulfilling the requirements, and, as a comparison, I will take the cab battery.

One make weighs 1,120 pounds and a 36-ampere discharge for three hours. One weighs 1,500 pounds for a 37½-ampere discharge for 3½ hours, and one weighs 1,000 pounds for a 36-ampere discharge for three hours, and the ratios of capacities and weights are the same for all other sizes.

I sincerely hope that those directly interested in the development of the storage battery for this purpose will deliver to us some information regarding difficulties they have had to overcome. I am frank to say that my experience up to date with the storage battery has more than met my expectations, both in capacity, weight and durability, and with such improvements as may be made from this time on, there need be no further anxiety regarding the success of the storage battery in such work. I have tried these vehicles under every condition of road and work that the vehicles can be put to, and my troubles with the storage battery have been far less under intelligent care and treatment than is generally given credit to by the public.

I noticed, recently, in one of our leading journals, an editorial which says that the hardest problem is the storage battery, which will "sputter, fume,

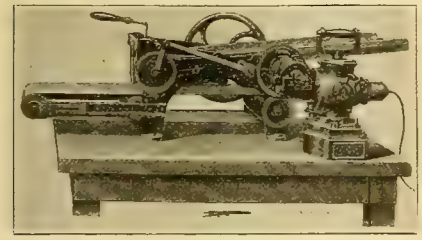

FIG 2. ELECTRIC MOTORS IN GERMAN HOUSEHOLDS.

give out on the road, leak, disintegrate, corrode, short-circuit," and so on, and I think that the gentleman who edited this article must have taken very little pains to inform himself as to the general status of the storage battery used to-day in the moto-vehicle. It would be just as consistent for him to say that electric-power and light plants were impractical because boilers would burst, engines break down, armatures burn out, street construction blow down, etc., all of which we know are possibilities, but are not probabilities under the advanced stage of the art.

From all this it would seem that there has been just as much engineering work in the development of the moto-vehicle down to the present day as there has been in many other propositions, and it is with great pleasure that I find many of the engineers in other directions so interested in the proposition, notwithstanding the fact that but few of them have considered it solely from an engineering point of view. It promises to be a great industry, and, ultimately, will throw large professional work toward other engineers than those directly interested in their manufacture; and it will always be a personal pleasure to me to give such practical illustration and information as lies within my power to my fellow-craft.

Electric Motors in German Households.

Noting the advantages of small electric motors, the Elektrotechnischer Anzeiger points out that, for many household operations, the electric motors save work and trouble. For such purposes the motors require little power, and they can be made in small dimensions that permit of their being easily carried about or moved. Fig. 1 shows such a motor made in Stuttgart, Germany, which can be connected by a flexible cord to an ordinary lamp socket. Figs. 2, 3 and 4 show the motor connected respectively to a macaroni chopper, a fork-polishing machine and a spice mill, but it is obvious that it may be used

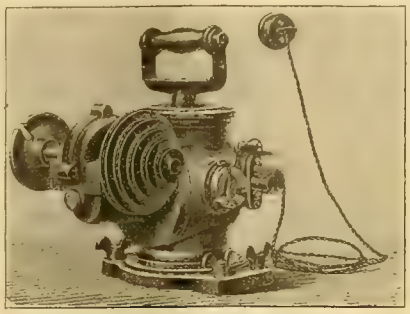

FIG. 1. ELECTRIC MOTORS IN GERMAN HOUSEHOLDS.

for any of thousands of purposes, such as kneading-machines in bakeries, bottle-washing apparatus, and for many uses in hospitals, restaurants, hotels, etc.

This motor is provided with a worm gear, whose shaft makes from 40 to 50 revolutions a minute—a speed necessary for driving the average machine for which it is built. At the end of the shaft is a cone pulley, by which it can be connected to the machine to be driven.

The amount of current used by these motors is very small, being not more than from 100 to 250 watts an hour, according to the size. Further, it is to be remembered that, as a rule, they are in actual use only for a short time. These advantages justify the prediction that before long the small electric motor for household purposes will come into general use.

In addition to the uses above mentioned, there are many others permitting the construction in one piece of apparatus of the motor and the machine to be driven. One of these is the electrically driven sewing machine, having under the table-top a motor of one-fifteenth horse power, which is connected with the machine by a cord; a switch and resistance at one side controls the starting and stopping, besides giving five intermediate speeds. The instantaneous stopping of the motor is accomplished through a brake contrivance directly connected with the resistance.

Inasmuch as the motor, at a moderate speed, requires but about 100 watts, the cost of running would be, on the basis of two pfennigs (one-half cent) per 100 watt-hours, only 20 pfennigs (five cents) a day of 10 hours' running.

Another machine of this kind is a wash-mangle, or laundry-ironing machine, which is connected with the motor by a worm gear; and to permit of the working of the goods backward and forward between the rolls, there is provided at a convenient point a reversing switch that the operator can use while guiding the goods through the machine.

Suspended Electric Railway in Germany.

Elberfeld and Barmen in Germany have for some time been connected by an electric street railway, which has lately become inadequate to meet the growing traffic. It has been decided, says an English paper, to install the Langon aerial system, the construction of which is now rapidly nearing completion. Inclined girders are placed from 50 to 65 feet apart, according to the course of the river Wupper, and rest on specially constructed foundations on its bank. They are held in this inclined position by means of girders at the top, which are connected with each other by a series of beams, to which the rails are attached. The entire line is eight miles long. For a small distance the inclined girders are supplanted by vertical ones. The stations are so arranged that they can be reached from the Wupper bridges by means of a stairway. This divides them in such a manner that there is a station every 1,500 to 2,000 feet. The cars seat 50 to 60 persons, and are suspended perpendicularly from rails attached to the longitudinal beams. The axles of the wheels are supported in movable trunnions, so that the long cars can be propelled with rapidity and without difficulty around small curvatures. The safety of this system is said to be greater than that of any other known system. The cars cannot fall down, and in case of the breaking of an axle several clutch arrangements immediately come into action and counter rollers prevent too great a swaying of the cars. The speed of the system is about 25 miles an hour. The cost of this two-tracked elevated system is estimated to be about $2,500,000. The contract has been let to a company in Nuremberg.

Co-operation for Electrotechnical Research.

Much valuable material may be secured through the efforts of the committee on co-operative research of the American Institute of Electrical Engineers, if the assistance of students and investigators having time and facilities for research is obtained in an appreciable degree. The committee consists of A. E. Kennelly, chairman, W. A. Anthony, Francis B. Crocker, Cary T. Hutchinson, Samuel Sheldon, C. P. Steinmetz and Elihu Thomson. These names inspire confidence, and the appeal for the sympathy and help of all engaged in electrotechnical research, to secure data valuable to all, should be heeded. Engineering professors, instructors and advanced students in colleges are particularly requested to give their assistance.

An interesting list of subjects for experimental investigation has been proposed. It is as follows:

1. The effect of sustained high temperature upon the insulation resistance of dielectrics.
2. The influence of sustained high temperature upon the dielectric strength of insulating materials.
3. The influence of sustained high temperature upon the hysteretic coefficient of commercial iron.
4. The influence of chemical impurities in iron or steel upon the hysteretic coefficient.
5. The hysteretic coefficient of magnetic alloys.
6. The temperature coefficient of resistivity in commercial copper wires.
7. The temperature coefficient of resistivity in commercial aluminum wire.
8. The temperature coefficient of resistivity in alloys commercially employed. (It is desirable to include analysis of the alloys tested as well as their physical properties.)
9. The highest conductivity obtainable in copper wire at any standard temperature.
10. The highest conductivity obtainable in aluminum wires at any standard temperature.
11. The analysis of dielectric losses between parallel copper wires maintained at high electromotive force—(1) alternating and (2) continuous—into component parts, such as chemical, electrical and mechanical.
12. The influence of wave form of alternating electromotive force upon the dielectric strength of dielectrics.
13. The influence of wave form of alternating electromotive force upon the sparking distance between needle points in air.
14. The influence of the room temperature upon the temperature elevation of dynamo machines under a given load as computed from their increase in resistance under load. (Sec. 32 of preliminary report of standardizing committee to American Institute of Electrical Engineers, June, 1898.)
15. The distribution of temperature elevation in field coils of dynamo machines as dependent upon their form and dimensions.
16. The relations between the "load loss" and "short-circuit core loss" of an alternator. (This has reference to paragraph 16d of the preliminary report on standardization to the Institute in June, 1898.)
17. The counter electromotive force of electrolytic deposition cells at potential differences ranging between the maximum polarization voltage and zero.
18. The seat of the increased counter-electromotive force in storage cells during rapid discharge.
19. The magnetic properties of alloys containing iron, nickel and cobalt.
20. The magnetic retentivity of powerfully twisted iron and steel wires, or of magnets composed of such twisted wires.
21. The permeability of magnetic materials at low values of magnetizing force.
22. The dielectric strength of different substances employed for insulating at different frequencies of alternation.
23. The influence of very high frequencies of alternation upon the sparking distance between needle points in air. (The highest attainable frequencies preferred.)
24. The dielectric strength of vapors of different substances.
25. Influence of wave form upon efficiency of converters. (The so-called rotary converters.)
26. The influence of magnetic field upon electrolytically deposited bismuth.
27. The conditions giving rise to sparking at commutators.

It is desirable that those selecting any subject or subjects for research communicate the fact at an early date to the committee, so that the works can be

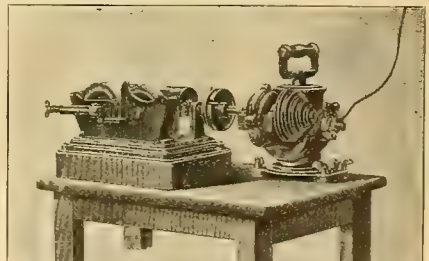

FIG. 3. ELECTRIC MOTORS IN GERMAN HOUSEHOLDS

intelligently carried on. Letters on this subject may be addressed to Mr. R. W. Pope, the secretary of the Institute, 26 Cortlandt street, New York, N. Y.

A Johannesburg (South Africa) correspondent of Electricity of London describes a curious incident at the Johannesburg town-lighting station resulting in the total wreck of one of the 150-kilowatt alternators, which was belt-driven from a Marshall horizontal engine. The machine suddenly lost its exciting current, owing to a fault in the exciter circuit. The load thus being removed from the engine, it raced, and a bolt holding one of the fieldmagnet poles broke, releasing the pole-piece, which latter, engaging with the armature coils, completely stripped them from the core, taking also bolts, screws, wood and insulation. Six other pole-pieces were bent, the shaft was found to have sprung, necessitating the complete removal of field magnets and pulley to get it straightened. The driving belt (12-inch double leather) was torn in two.

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Conflicting reports concerning the effect of the recent storm upon the underground conduit trolley system in New York are presented in the daily papers and the Associated Press reports, but it is generally admitted that there were delays and disappointments, and that for a time, at least, the system was tied up. It must be remembered, however, that the storm was the most severe that has visited New York in many years, that overhead trolley lines were crippled in Brooklyn, Newark, Jersey City and other cities in New Jersey and throughout Long Island, and that steam roads had to suspend operations. The storm was so bad that it affected every agency of communication, including the telegraph and telephone companies. The storm extended as far west as the Alleghanies, between the Carolinas and Nova Scotia, and was most severe along the coast between Cape May and Cape Cod. This was shown by the condition of the wires. Sandy Hook, Long Branch and other points along the Jersey coast were cut off. Ship news was reported from Quarantine and from City Island, but not from Sandy Hook or Fire Island. The coast wires on Long Island were interrupted, both on the south and north shores, but the wires in the central part of the island near its western end were in operation.

American manufacturers of telephone apparatus who are looking for a larger field for their products will doubtless take advantage of the Paris Exposition of 1900 to introduce their wares to the favorable consideration of visitors at that exhibition, and afford the world an opportunity to compare American workmanship with that of other nations. Americans are achieving flattering results in direct competition with foreigners in European and Asiatic markets, and they have already made an impression on South American trade. It is in the Orient, however, that present interest centers. No doubt our operations at Manila have done much to stimulate interest in that part of the world, but even before the success of the American arms in the Philippines, Yankee ingenuity and enterprise had been recognized as a powerful factor in the commercial world.

A British Foreign Office report is responsible for the statement that during the last year there has been a very satisfactory advance made in the imports of foreign merchandise into Japan, and that the United States is more than holding her own against European nations. In electrical and mining machinery especially is this noticeable, as there has been an increase from $554,781 in 1896 to $1,299,356 in 1897 in the value of imports. Of this amount Great Britain supplied 56 per cent., the United States 28 per cent., Germany 12 per cent., and the remainder was furnished by several other countries in small amounts. Up to a very recent date the telegraph wire used in Japan was imported exclusively from England and Germany, but during the last year American manufacturers have made an attempt to enter that field of competition, and their efforts so far have been successful.

Reports of this kind, which are constantly being made, not only by Americans abroad, but by the representatives of European nations, indicate clearly the change in the conditions that prevail everywhere. It is gratifying to American pride and beneficial to American industries.

The inquiry into the circumstances attending the loss of the Mohegan was concluded at London on November 25th, and the findings of the court were announced the next day. The decision disposed of the theories that had been advanced regarding the influence of "magnetic rocks" upon the vessel and her equipment. The court found, among other things, that the vessel's compasses were in good condition and could not have been affected by an electric current, and that the Lizard lights were never seen by those in charge of the movements of the vessel, because the Mohegan never got within the arc illuminated by them. The cause of the vessel's stranding was declared to have been that she was steering the wrong course, west by north having been steered after passing Eddystone Light. Another important finding was the fact that so few of those on board were rescued was due to the absence of light. The court recommends that in cases where a vessel is lighted by electricity she should also have accessible oil lamps in case of the failure of the electricity.

At the time of the disaster it was suggested that the magnetic disturbances might have affected the needles of the ship's compasses, but this claim was opposed by the highest authority in Great Britain, Prof. Rücker, who personally conducted the magnetic survey of the country and was familiar with the subject. He pointed out that the conditions precluded the possibility of such action. The theory that the ship had been "drawn" upon the rocks as a result of violent magnetic disturbances at the Manacles was dismissed as a sailor's yarn.

The conclusion of the court of inquiry that oil lamps should be kept in readiness presents a new feature in ship-lighting that must be met by electrical engineers. It would seem that a much more satisfactory provision would be made by installing a few storage batteries, but it is to be deplored that such a need should be felt. One of the chief claims for the electric light has been its reliability under all conditions, when the plant is properly installed and intelligently operated, and it will certainly be with great reluctance that the finding of the board in the Mohegan disaster will be accepted. It is quite probable that some satisfactory explanation is to be found in the condition of the plant or the care it received.

In the annual report of the Weather Bureau of the United States it is announced that important extensions have been made, so that the field of operation now includes all the West Indies, the shores of the Gulf of Mexico from Galveston to Campeche Bay, thence around Yucatan and along the shores of the Caribbean Sea to Trinidad. Stations manned by expert observers and equipped with the most approved forms of modern instruments have been established at Kingston, the local headquarters of the service, Santiago, St. Thomas, San Domingo, Barbadoes, Trinidad, Curacoa and Baranquilla, while arrangements have been made for obtaining observations from Colon, Merida in Yucatan, and Coatzacoalcos, Vera Cruz and Tampico on the Mexican coast. Although the protection of the United States naval forces during the recent Spanish war was the primary object in organizing the new service, the step has proven a wise one on account of the strengthening of the storm-warning system of the Gulf and South Atlantic coasts. American shipping interests have already profited by the service.

Another important feature of the work of the weather bureau during the year was the development of the system of kite observations. Prof. Moore says it is too early to determine the utility of this line of investigation, but the bureau is getting valuable experience. Sixteen stations had been fully equipped by the first week in June, and 278 actual ascensions, in all of which the elevation attained exceeded 1,000 feet, were made during the remainder of the month. Among the many natural obstacles in the way of successful kite flying, the destruction of kite wire by electric discharges in the neighborhood of an area of thunderstorms gave some trouble. Interesting statistics have been collected under the supervision of the bureau bearing upon the damages done by lightning, especially in farming districts.

We are near the end of a century of marvels, and the closing years bid fair to surpass the previous ones in electrical discoveries. Moore and Tesla in the East are reaching toward the great unfathomable beyond, to produce light without heat or danger; Marconi and his disciples are aiming to give the world a system of telegraphy without poles and wires and increase the value of Western Union by cutting down expenses. But not in the eastern states nor in Europe does the great electrical necromancer reside. Kansas claims the discoverer of the electric concentrator, by which electric lighting will soon become cheaper than lard oil and as harmless. Here is what the solon says, and it is only to be regretted that he fails to inform his prospective much-to-be-pleased patrons whether the concentrated electricity is produced in the crystalline form or is boiled down to a thick syrup only:

The electricity is generated by an Electric Concentrator. It has an armature 3 inches in diameter and 15 inches long. This Armature has a speed of one revolution per hour. The power of the Concentrator No. 3, 4, and 5 consists of a holder made of Galvanized Iron and resembles a half bushel in this is placed 150 pounds of earth or dirt. [The choice is presumably with the purchaser.] The simplicity of the machine allows but very little repairs and many years of good service can be obtained from it.

It requires but very little attention and your light can be obtained at any hour of the night. All that is necessary is to turn the switch and you get the light, neat and clean free from all odors, it won't blow out when you raise a window to get a breeze.

Those who desire to be up to date in Electric lighting can purchase our improved Electrical Concentrator at a very low cost which they will be well pleased with their purchase.

Electricity produced by the natural gravitation of the Earth.

It is the result of application and research by which he has succeeded in performing that to which has been given without result the energy of many great minds.

It is pronounced by scientists and experts as a superior article. [The concentrator or its electricity?]

After the foregoing verbatim extracts from the circular, who can contend that grammar and punctuation, the "basting and seasoning of composition," are a hamper to true genius.

Losses in Transmission by Belts and Shafts.

It is now generally appreciated that the loss in transmitting power from the point of generation to the point of application is very great, and that it often costs as much to get power to the tool as it does to utilize it at the machine. Additional figures upon this question, however, are always welcome, and some interesting data upon the power consumed by shafting and belting are found in the paper upon the Midland Railway electric plant, recently presented before the Institution of Mechanical Engineers by Mr. W. E. Langdon, and abstracted in the Engineering Magazine.

The main shaft is driven by belting from an Elwell-Parker motor, erected some years since. To drive the main shaft alone, quite free from belting, required an expenditure of 272 watts (0.36 horse power, the shaft being 98 feet long, two inches diameter, with 12 bearings each 4⅜ inches long. To drive it with 19 belts resting on it, but free from the tools, absorbs 518 watts (nearly three-fourths horse power), while the main shafts, belts and countershafts together require 794 watts (1.06 horse power). The power required to drive a 9½ screw-cutting lathe without any cut, while all the other machines and belts were at rest, clear of the shafting, required 381 watts, while the power absorbed when the tool was turning down a bar of gun-metal at the rate of 1.1 ounce per minute was only 545 watts, or at the rate of 495 watts per ounce per minute; or, in other words, the lathe running light consumed 381 watts, and the work done 164 watts.

By gearing an electric motor of low efficiency direct to the same lathe, and setting it to precisely the same description of work, the power consumed was at the rate of 214 watts per ounce per minute. In each case the greatest care was taken to insure equality in the cutting power, shape and cut of the tool, and one cut only was made.

Comparative tests were made for one, two and three cuts effected by the same lathe when driven from shafting, and when driven by a small motor, both being geared down to the same speed of lathe.

The advantage due to direct driving is clearly seen in the following results:

When driven by belting:

Power .....1,188 watts
Metal cut .....9.75 ounces
Time occupied.....2.25 minutes

being an average of 275 watts per ounce of metal removed per minute.

When driven by motor direct:

Power .....616 watts
Metal removed .....9.75 ounces
Time occupied.....2.25 minutes

or an average of 143 watts per ounce per minute, thus showing the direct-connected motor to have about double the efficiency of the belt-driving.

"The results would no doubt have been more interesting," says Mr. Langdon, "if obtained from larger tools, capable of doing heavier work. Under such conditions it is probable the waste of power in shafting and belting would not be so great in relation to the work done. Still it is clear that an extensive loss does take place, and that this may be reduced by driving each tool or machine direct from an electric motor. If every foot of the shafting and every machine connected with it were constantly at work without intermission of any kind, the difference would not be so marked; but this is just what does not happen. Shafting is extended down a long shop, and scores of tools are driven by it; whether they are all at work or not, the shafting has to be kept running. This entails a certain initial loss. With large tools, or machines absorbing over one horse power, there can be no question of the advantage derived from driving direct by electricity."

Lightning and Lightning Arresters.

Mr. Alexander J. Wurts of Pittsburg read a paper on November 22d before the electrical section of the Franklin Institute, on "Lightning and Lightning Arresters." Mr. Wurts said in substance:

In earlier days, when people were more superstitious than now, fires were lighted and bells tolled to drive away the dreaded lightning; but when Benjamin Franklin established the identity between lightning and electricity, people were glad to accept the results of his experiments and adopt so reasonable a device as a lightning rod. The lightning rod was a reasonable device at that time, because the public mind was ripe for it, and Franklin had shown that not only would the rod prove a good conductor, but that points on its upper terminals would, in certain circumstances, prevent the lightning discharge. But now, after 100 years' experience, and with statistics before us, this means of protection has lost much in popularity. Aside from public buildings and houses of the less intelligent class of people, the rod is rarely seen. Statistics show that in nine years ended in 1893, in the United States, there were 4,175 fires, with a loss of $14,000,000. During 10 years ended in 1893 there were 2,679 barns, 129 churches and 831 dwellings struck by lightning—less than 100 dwellings a year out of the millions in this country. During five years ended in 1894 there was a maximum loss of 336 lives. These figures are certainly not alarming, but do not seem to warrant in general the use of the lightning rod. The speaker recommended this device for costly and prominent buildings, for tall monuments, church spires, brick chimneys, etc., especially in rural districts.

Experiments were then shown to illustrate how the lightning stroke gathered into a bolt. It was also shown that the kind of metal of which the rod is constructed is of small importance. Globular lightning was thought to be a fact, and a letter was read from an eyewitness. Some interesting experiments were then shown, illustrating the damage done to electrical apparatus during the thunderstorms. Various devices were arranged on the experimental table which had been designed for the protection of dynamos and motors.

In conclusion, Mr. Wurts stated that although much has been learned in recent years about lightning and atmospheric electricity, nevertheless there are still mysteries to be solved in this fascinating field of natural science.

Safety of Brooklyn Bridge.

An important document has been published by the Railroad Gazette, which, while of particular interest to the people of Greater New York, presents an engineering problem that cannot fail to attract universal attention. In that communication Washington A. Roebling, the builder of the New York and Brooklyn bridge, declares that the bridge is overloaded, and plainly intimates that the blame for this state of things rests upon the municipal authorities having charge of the structure. Mr. Roebling says:

"About fourteen years were consumed in the construction of the East River bridge. At the beginning neither elevated roads run by locomotives nor electric roads were thought of. When the bridge was half finished the elevated road demanded the right of way, and shortly after its completion the electric road also pressed for recognition.

"In 1880 some of the bridge trustees, notably W. C. Kingsley, insisted that I should adapt the bridge for the passage of elevated locomotive trains, to take the place ultimately of cable-propelled trains. I yielded with reluctance and against my better judgment. It implied directly a greater load on the cables and indirectly a still greater load, because the heavier load demanded greater truss power against deformation. As a compromise, the central trusses were raised, while the outer ones were left at the original height; all of which is structurally wrong, leaving the outer truss liable to such minor accidents as the recent buckling.

"A further source of increased load arose from the widening of the roadways, giving each a double track instead of a single track and useless sidewalk. The adoption of a cable grip, whereby two alternating trains were replaced by numerous circulating trains, also added much to the moving load. I partly provided for this increase by using high cast steel wire for the cables. The margin of safety, however, suffered a material reduction.

"But the crying evil on the bridge is that every year since it has been opened to traffic there have been numerous additions to the dead load, small in themselves, but large in the aggregate. They amount to fully 15 per cent., if not more, all of which must be multiplied by a factor of tension of 1.70, and is intensified by being carried chiefly by the two middle cables. They comprise, for example, telegraph cables and wires, pneumatic tubes, double lines of rails, fastenings, sheaves and ropes, trolley wires with extra heavy supporting brackets, heavy rails for trolley cars, heavier planking, electric light stands, etc.

"The climax of overloading was reached when the trolley took possession of the roadways and began to run in defiance of all stipulation as regards weight of cars or distances apart. I can readily believe that the incident of a horse dying on the track caused a blockade of cars, which increased the live load from two to even three times what it was fixed at originally. Similar blockades on a smaller scale have happened before, and the bottom chords have buckled before, and, in all probability, will buckle again.

"It has been charged that but for my acquiescence the trolley would never have gained a foothold on the bridge. But where is the man who ever succeeded in preventing a trolley from going where it wanted? The prospective advantages, both from a pecuniary view as well as in the increase of transit facilities, were so enormous that no power, barring the actual collapse of the structure, could have kept them off. I had thought that with full regulating powers vested in the bridge authorities we might run the risk, and in that I was mistaken.

"What is needed at present is a recalculation of the loads and weights of the bridge, so as to determine the present margin of safety in the main parts of the structure, such as cables, anchorages, etc. Application to this effect has been made to the proper authorities by me without any satisfactory result as yet.

"I have no fear of the cables. They still have ample strength, and could pull up the anchorages with ease.

"After such investigation we can determine whether it is advisable to lighten the structure and relieve it of at least a small portion of the load, which is constantly being added to, even now. To reinforce the cables would be a difficult, if not impossible, task. The anchorages can be reinforced."

Under instructions from Bridge Commissioner John L. Shea, Chief Engineer C. C. Martin of the Brooklyn Bridge has prepared an elaborate report treating of the distribution of weight on the bridge, the buckling of the truss last summer, the margin of safety and the changed conditions in the structure through the operations of the trolley cars and elevated roads. Mr. Shea is reported as saying that, while he had every confidence in the opinion of the many engineers who had discussed the Brooklyn Bridge question, he thought it best to call upon the regular engineer for his views. It is expected that the report will be submitted at an early day, and while declining to outline his deductions, Mr. Martin reiterated his previous statements that the bridge was perfectly safe and would support a much greater strain than it is at present subjected to.

Combination of Elevator Companies.

The combination of elevator manufacturing companies which was first reported in the Western Electrician seems now to be effected. The details of the consolidation were worked out in the East, and from New York comes the statement that the new corporation, which will be called the Otis Elevator company, will represent the consolidation of all the leading companies, the yearly output of which is more than 90 per cent of the total yearly production of elevators. The capital stock is to be $10,000,000, of which, $4,000,000 is non-cumulative preferred and $6,000,000 common. The assets turned over by the constituent companies aggregate $1,000,000 cash, real estate valued at $525,000, equipment, machinery and appliances valued at more than $2,000,000, and patent rights of the value of more than $3,000,000. Practically the whole issue of the stock was taken by a few of the leading bankers of New York.

William D. Baldwin, treasurer of Otis Bros. & Co., has been the most active promoter of the consolidation, and will probably become president of the new corporation.

Following are the names of the companies which are said to be included in the new combination: Whittier Machine company of Boston, Standard Elevator and Manufacturing company of Chicago, Otis Bros. & Co. of New York, Smith-Hale Elevator company of Quincy, Ill.; Graves Elevator company of New York, Morse-Williams company of Philadelphia, McAdams & Cartwright Elevator company of New York, Crane Elevator company of Chicago, National Elevator company of Illinois and the elevator business of the Sprague Electric company.

American Institute of Electrical Engineers.

At last week's meeting of the Institute, the paper of the evening, on "The Design of Transformers," by F. W. Carter of London, England, was read by Prof. W. S. Franklin of Lehigh University in the absence of the author. It was discussed by Messrs. Franklin, W. B. Jackson, Wolcott, Henshaw, Torchio and others.

At the meeting of the executive committee in the afternoon the following-named associate members were elected: Cleveland Abbe, Washington, D. C.; John Cassidy, Honolulu, Hawaii; James Francis Cosgrove, Scranton, Pa.; Donald Hume Fry, San Francisco, Cal.; James Hamilton, Boston, Mass.; Bernhard Hoffmann, New York, N. Y.; Harry D. James, Yonkers, N. Y.; S. L. G. Knox, Ampere, N. J.; Howard Wallace Leitch, Brooklyn, N. Y.; R. W. Lohmann, Oakland, Cal.; C. Stowe Reno, Cincinnati, Ohio; R. H. Sperling, Victoria, B. C.; James Wilkinson, Birmingham, Ala.; A. Wilford Zahn, St. Paul, Minn.

The following-named associate members were transferred to full membership: Franklin Robert Anson of Salem, Ore., Sidney Hand Browne of Baltimore, Md., and A. E. Brooke of San Francisco.

Snowbound on a Trolley Car.

[From the Minneapolis correspondent of the Western Electrician.]

The recent blizzard had a disastrous effect on the street-car lines of the Northwest. In Des Moines, Ia., the service was entirely suspended during the storm and the morning of the day succeeding. Minneapolis had intermittent service during the storm, though on some of the outside lines it was hardly that. On the new Como Interurban line a car got stalled in the afternoon of Monday, November 21st, with 25 passengers, near the St. Paul workhouse, and for 22 hours the passengers were snowbound. Some of them pushed out through the blinding storm and sought relief from the old Interurban, which still kept up a spasmodic movement. Others went to the workhouse and telephoned for carriages. Part of the passengers stayed it out, but were compelled to make a raid on the workhouse for something to eat. The street-car company sent out a bus to rescue the lost, but it took the rescuers several hours to reach the place. On some of the other Twin City lines the service was tied up and remained so for from six to 48 hours.

Electric Cabs the Best in a Storm.

One result of the exceptionally severe snowstorm of last Saturday and Sunday in New York was to demonstrate the superiority of electric cabs. The Tribune of that city says that the electric motor cabs were found to be more available than any other form of transportation during the heaviest part of the storm, and they did a large business in the hotel and theater district.

DEVELOPMENT OF THE TELEPHONE FIELD.

Clearing-out Signals for Central-office Switchboards.

By H. P. Clausen.

One important feature in a central-office equipment is the means provided for enabling an interconnected pair of subscribers to produce an efficient clearing signal after the completion of a conversation. The means provided by manufacturers of telephone apparatus are many, though as a rule they differ only in constructive details. The author will therefore confine himself to a description only of such systems as have already served and proved their practicability, and endeavor to present the subject of clearing signals in an easily understood and non-technical manner, which he believes will be most acceptable to the managers and superintendents of the smaller independent exchange systems. In order to have a basis for consideration, I will divide eight of the more important systems of disconnecting signals in as many classes, and give a description of each class in the order named:

(1.) Series clearing-out signals, direct drop.
(2.) Series clearing-out signals, relay drop.
(3.) Bridged clearing-out signals, direct drop.
(4.) Bridged clearing-out signals, relay drop.
(5.) Series clearing-out signals, automatic.
(6.) Series clearing-out signals, automatic supervising indicator.
(7.) Bridged clearing-out signal, automatic.
(8.) Bridged clearing-out signal, automatic supervising indicator.

The first class of signals includes all electro-magnetically operated indicators having their wire winding included in a series circuit with the telephone circuit. The earliest form of indicator was that in which the subscriber's line drop was made to serve the double purpose of recording his desire for a communication and making known his desire for a disconnection after completing a conversation. In the earlier type of line signals, however, a serious difficulty presented itself, namely, the mixing of a conversation passing over a given circuit with that passing over another, whenever their respective line signals happened to be located within a few inches of each other. Moreover, there was another interference experienced while an operator was required to serve a comparatively large number of individual lines, which was due to the fact that a hurried operator, if he failed immediately to restore the indicator announcing a disconnecting signal—after testing and withdrawing the connecting plugs—would often be obliged to again insert his operating plug into the line-jack corresponding to the fallen shutter, and test out in the usual manner, which frequently led to ringing the subscriber's bell in order to be assured as to the caller's needs. This naturally was the cause of much confusion and loss of time, and eventually resulted in the abolishment of the plan, the old clearing signal in the larger central-office equipments giving way to a more effective and easily observed signal normally in circuit with the several pairs of connecting cords. The series clearing-out drop, forming a part of each set of connecting cords, is, of course, subject to the same mixing effects as was observed before, with the advantage in favor of cord circuit-clearing signals that the signal receiver can be permanently placed a sufficient distance apart for obliterating the effects of mixing or cross-talk.

The series clearing signal, relay drop, was developed in order to overcome the necessity for winding the clearing signal to a resistance where it would become a serious bar to the passage of telephone current. The relay proper, connected in series, each with its respective cords and plugs, was placed at a distance from the switchboard. It consisted of a comparatively large size but low-resistance electromagnet, arranged with a delicately pivoted armature, to which a light platinum-pointed contact spring was fastened, which was set in relation to another platinum point, so that the least current when traversing the electromagnet winding tended to draw the armature toward the pole-pieces, causing the platinum point to make contact. The object of making this contact was to close a local circuit containing an auxiliary annunciator, which was located on the switchboard in a position corresponding to its respective connecting cords and relay. Inasmuch as the secondary drops did not at any time form a part of the telephone circuit, it is obvious that no matter how close they might be set or grouped, no cross-talk could be produced.

The bridged clearing-out signal, direct drop, when introduced, overcame a difficulty experienced with clearing signals of the series type, that is, when only one plug of a given pair was inserted into a line-jack and inadvertently left there, the subscriber connected to the line would not be able to operate either the line or clearing signal; in other words, it would result in an open circuit at the central-office end of the line. Such a condition of circuits could not be produced when the clearing-out drop was connected across both sides of the telephone circuit (in an earth-return system, the earth as a common and the connecting cords as the selective side), as the circuit would then be complete even if only one plug was inserted into the line-jack.

The bridged clearing-out signal, relay drop, was developed partly to obtain immunity from cross-talk, but chiefly for the purpose of obtaining a more sensitive clearing-out signal, auxiliary-secondary drop. The need for this was felt when a distant subscriber attempted to operate the clearing-out signal at the central office, after having completed a conversation with a previously connected short-line subscriber. This effect was due to the fact that the telephone-bell coils absorbed most of the current generated by the long-line subscriber while operating the magneto-generator, and failed to operate the bridged clearing-out drop.

Series clearing-out signals, automatic, were designed in order to relieve the telephone user of the necessity for making a special effort toward transmitting a clearing-out signal over the circuit after completing a conversation. As a rule, the object was accomplished by having a common and constantly charged wire connected to every telephone instrument, and in such a manner that the removing or replacing of the telephone receiver caused the hook-switch to momentarily make connection with the charged wire, whose opposite pole of course was connected to the earth or common-wire return circuit.

The series clearing-out signal, automatic supervising indicator, is, as its name implies, an arrangement for aiding an operator in determining the condition of the subscriber's circuit, in case either or both of a pair of interconnected telephones might be still in use. Briefly, each operator is provided with a double-contact plug connecting in series with several cells of battery and an ordinary upright form of galvanometer. The subscribers' connecting cords, instead of being equipped with the usual clearing-out drops, have their terminals brought out into a normally closed jack; that is, one jack for each set of interconnecting cords. After connecting through a set of subscribers, the operator, by plugging into a corresponding jack, may determine the condition of the subscriber's instruments without cutting in the operator's equipment, by noting the deflections of the galvanometer needle. Normally the galvanometer needle would lie at least at the left side of the scale, but when connected to a line by means of the plug and jack the battery current would flow through the galvanometer windings, as well as both telephones, and deflect the needle. Inasmuch as the telephone bells are generally wound to 80 ohms resistance each, the deflection would be greatest if both telephones had their bells in circuit; if, however, both telephones are in use, each would probably represent at least 350 ohms resistance; naturally, therefore, the galvanometer needle would not be deflected nearly as much as with both telephone bells only in circuit; again if one telephone had its bells in circuit and the other its receiver and induction coil, the galvanometer needle would lie almost midway between the smaller and larger deflection.

The bridged automatic and bridged supervising indicator are operated upon the same general plan as those built for a series system. However, the bridging plan of connecting is much preferable to the series, chiefly on account of the disturbances produced in the telephonic circuit when the series type of apparatus is employed.

Telephone Situation in England.

[From the London Electrical Engineer.]

A careful examination of the question brings us to one conclusion, and one only, as satisfactory. The government should make up its mind at once as to the course of action it intends to pursue. The preferable way would be to approach the company with a firm offer of purchase of apparatus as it stands, with a firm offer to pay the actual cost expended on extensions less depreciation as agreed upon, such extensions to be carried out under the direction and according to the specification of the government. Few municipalities will enter into competition with the existing company, because it would mean in most cases the loss of a greater or less amount of money. Their licenses, if obtained, would elapse in 1911—that is, in about 12 years. It could hardly be expected that in face of keen competition—and the competition will be very keen—the capital expended would earn any return for a few years, much less earn interest, in addition to depreciation. The government must either buy the installations in 1911, or with the lapse of the licenses telephonic communication stops—yes, blankly stops—or must erect installations to compete with the company up to the date 1911, and supersede the company's installation at that date. Assume that the government will buy and not compete. The purchase money to the municipalities will not include the losses incurred by competition; hence they have little inducement to enter into competition, for under the most favorable conditions they can hardly hope to make sufficient profit in the time to equal the first losses and the annual depreciation. Then we must also take into consideration the march of "progress." Automatic or other central stations may be all the rage in 1911, but the government may refuse to buy the present old-fashioned boards. Readers can work out these views at any length they please; they will hardly come to any other conclusion but this, "that immediate and effective competition" is not to be expected from many, if any, municipalities. If this conclusion is correct, the government and the company are still face to face, and if "immediate and effective" competition is to come at all, it must come through government action. Let us assume, then, that municipal competion is generally out of the question. The government has two courses open: To at once enter into competition or to arrange to buy. If they decide to enter into effective competition, they must so arrange matters that the telephonic public does not suffer in 1911, and it is a little difficult to see how they can arrange for this unless they put instruments free into all places where the company has instruments. Many subscribers might be expected to change over to government installations, but we doubt if the company would not, by fighting hard, succeed in keeping by far the greater number. The company should know what its fate is to be in 1911. Under competition it would be saddled with so much old material for the scrap heap, hence it would not feel disposed to make the competition easy for the incoming powers. All things considered, we believe our suggestion of immediate purchase to be the best one under the circumstances.

Telephony Abroad.

Proposals are solicited for the establishment of a telephone system in Snanghai, China. The council has been authorized to grant an exclusive franchise for such a system for 30 years. Bids will be received until March 31, 1899.

A curious reform is mentioned by an exchange as having been carried out in connection with the Vienna telephone service. Experience has shown that the dust clinging to the dresses of the telephone girls when they arrived at work found its way to the instruments, and caused disturbances in the telephonic service. To avoid this the girls will now be required to wear a uniform during office hours. On arrival the girls are to remove their street dresses and put on others provided by the government. The girls are also compelled to take off their boots, and substitute for them a slipper-like shoe. It is remarked by an English journal that at the late telephone inquiry in London the language sometimes used through the telephones had resulted in more than one fainting fit. The operators certainly have enough to bear without placing them in uniforms.

A resolution has been passed by the telephone committee of the Manchester City Council providing that a report be prepared for presentation to the City Council setting forth the recent communications with the postmaster-general and embodying the general conclusion that, in view of the proposed action of the government in this matter in the next parliamentary session, it is desirable not to proceed further conferring powers upon the corporation to provide and work telephones under license from the Postoffice, and that the chairman be requested at the next council meeting to ask permission to withdraw the following item from the objects of the bills: To confer powers upon the corporation to provide and work telephones under license from the Postoffice, with all necessary powers for that object, and that a similar course be also taken at the meeting of owners and ratepayers.

The annual report of the Queensland Post and Telegraph Department for the year 1897-8 contains an interesting item relating to telegraph and telephone business. Queensland has commenced the construction of trunk lines connecting its principal urban telephone exchanges, and the result of a full year's working upon one of these lines from July, 1897, to June, 1898, is presented in the report. The experiment was between Charters Towers and Townsville, and its effect was to reduce the revenue from telegrams from £76 to £52, the earnings of the trunk telephone wire rather more than compensating for this loss. Simultaneously there was a very large increase in the number of subscribers to the exchanges at both ends. The exchanges, as well as the telegraph and telephone lines, belong to the government, which consequently clears a satisfactory profit on the business as a whole.

It is said that the telephone is being tried in railroad service in many European countries. In France the managements of some of the railroad companies contemplate replacing the telegraph by telephone, even for the transmission of important orders. There are some railroads with light traffic where the telephone is already used, but the entire substitution of the telephone would be difficult. The single iron conductors used for telegraph would not be suitable, and it would be necessary to establish special telephone lines with double wires. The Northern railway of France has established trial telephone stations on the open road along some of its main lines, through which asistance can be summoned from the stations in case of accident. The large Austrian railroads use field telephone instruments of the Gattinger system, which in a few minutes can be connected with the telegraph wires at any point, without interrupting the telegraph communication. Under favorable conditions conversation is possible at a distance up to 31 miles. In England telephone connection between block-signal stations is common.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

A telephone system is being constructed at Pleasantville, Ia.

At Adel, Ia., the telephone is credited with reducing the crowd attending court. Formerly litigants, witnesses and attorneys had to be on hand constantly to make sure they would be present when their case was called. Now, the crowds go about their business, and only attend court when they are telephoned that their case is about to come up.

The Central Telephone company has connected with Metz, Ia. The company has also made connections with Newton, Ia.

A long-distance line from New Virginia, Ia., to Medford gives the latter toll service.

Reduced rates for telephones at Hampton, Ia., is resulting in greatly increased use of them.

The Jefferson Telephone company at Jefferson, Ia., has added some improvements to its central office lately.

The Rock Valley Telephone company has completed a line into Sheldon, Ia.

The Lamoni Telephone company of Lamoni, Ia., ran a temporary wire into the office of the local paper and furnished it election news at the late election. W. A. Hopkins and Bert Teale, doing business as the Lamoni Telephone company, have dissolved partnership, W. A. Hopkins succeeding to the management of the property.

Professor Hocker is arranging to put in some improvements in the switchboard of his telephone exchange.

The comptroller of St. Paul has held up the bills for telephone service for the fire department for two years, and the company is now advised it will have to sue to recover. The reason is that the services were contracted for covering a period of three years, and the charter does not allow a contract to exceed one year.

The Western and Central Minnesota Telephone companies have arranged for a connection at Fairfax, Minn., to improve the service on through business.

The Eau Claire (Wis.) Telephone company has been awarded the contract to furnish telephones for the county at the rate of $24 per annum. The Bell company service will be discontinued.

The Pacific Automatic Telephone Exchange company has been incorporated at Seattle, Wash., to put in an automatic exchange.

Thomas McDonald of Drayton, N. D., expects to construct a telephone line to St. Thomas, N. D., in the spring.

A heavily charged wire of the Butte Electric company came in contact with a telephone cable at Butte, Mont., recently and burned out 250 instruments. It took the company nearly 10 days to repair the damage.

The local and Midland telephone companies at Adrian, Minn., are expecting to connect with the Northwestern Telephone Exchange company at that point.

The telephone exchange at Red Wing, Minn., will hereafter put in instruments on what is called the California system. It consists of telephones that cannot be called, but can be used to call others. The cost is $1 for residence and $1.50 for business use.

Arrangements have been made for the construction of a telephone line from Dundas, Minn., to Millersburg, Lester, Wheatland and Montgomery, with a branch to Shieldsville. Work will be begun at once.

The Northwestern Telephone Exchange company is taking up the line through Grand Meadow, Minn.; which it recently bought from the Western Electric Telephone company.

The Iowa Telephone company, which is now operating a telephone exchange in Creston, Ia., is an applicant for a franchise to the council. J. B. Harsh and C. S. Rex also want a franchise. A third request for a similar favor comes from John Hall and others.

The new telephone exchange has been completed at Adel, Ia., and starts out with 45 instruments in use.

Over 50 subscribers have been secured at Waupun, Wis., for a telephone exchange. The materials have arrived and work is to be pushed to completion at once.

The Lamoni (Ia.) Telephone company has built a line to Davis City.

Citizens of Janesville, Wis., propose to establish an exchange there to secure lower rates.

The Wisconsin Telephone company recently attempted to set poles in Marshfield, Wis., first being armed with an injunction to prevent the city authorities from interfering with it in any way. The city immediately served counter injunction papers forbidding the company to proceed. In the meantime the company had set about eight poles. The workmen were ordered to quit. During the night the poles that had been set were cut down. The city is determined to keep the company out, unless it will agree to certain terms laid down when it sought an entrance some time ago.

The Wisconsin Telephone company has installed a new switchboard at its Ashland office. It is considerably larger than the old one, and has many improvements.

County Commissioner King is building a telephone line from Fessenden, N. D., to connect with Emrick, Cathay, Sykeston, Carrington, New Rockford and other towns.

The Dakota Central Telephone Exchange company will build a line to South Shore, S. D.

The recent blizzard in Minnesota affected the telephone systems in St. Paul and Minneapolis somewhat, but the damage was slight and was easily and quickly repaired. The long-distance lines did not suffer.

The long-distance telephone has reached Jamestown, N. D., and that city now has connection with Grand Forks.

The telephone line at Clark, S. D., will be extended from Willow Lakes to Bryant, S. D., at once.

Long-distance connection has been completed to Howard, S. D., over the lines of the Dakota Central Telephone company.

The Farmers' Co-operative Telephone company has completed its line between Boone, Ia., and Mackey.

A daughter of Mrs. Margaret Burke of Des Moines, Ia., chief operator of the Iowa Telephone company in that city, was married recently to E. J. Moran.

A telephone was utilized in Keokuk, Ia., recently to carry the sermon of Rev. Dr. Newcomb to the hearing of Mrs. H. C. Sinton, who was confined to her bed. A desk telephone was placed on the pulpit and concealed in a bouquet of flowers. Mrs. Sinton heard every word of the discourse, as well as the singing. The speaker took no special pains to talk into the receiver.

London Telephone Service.

The discussion of the telephone service furnished by the National Telephone company in London has provoked the following statement from W. E. L. Gaine, the general manager of the company:

"It is charged against the company that its service in London is inefficient and inadequate. My reply is that to whatever extent it may be so at this moment is entirely the fault of the London County Council. In May, 1896, the company applied to the County Council for the consent of that body, as required by the telegraph act, 1892, to enable the company to place its wires underground—the only solution of the serious difficulties which otherwise beset the company from the use of overhead wires. Prolonged negotiations followed, and, finally, terms were agreed and embodied in a series of resolutions passed by the County Council on June 1, 1897. Nothing further remained to be done but to prepare and execute a formal agreement to give effect to the bargain. These negotiations, it will be seen, occupied rather more than a year. It took the County Council nearly seven more months to prepare the draft of the formal agreement, and this document was submitted to the company for consideration on January 29, 1898. It was then found that two additional conditions not forming part of the bargain had been inserted. These conditions were—(1) That the company should make a wayleave payment to the County Council, which would impose a burden upon the company amounting to several thousand pounds per annum, and (2) that the company should reduce its tariffs to an arbitrary scale as fixed by the County Council, which would involve the company in an immediate loss of revenue of upward of £40,000 per annum. The company considered that the importation of these conditions after more than 12 months had been spent in concluding the bargain was not in accord with good faith. The company replied that, as it had agreed to make wayleave payments to a large number of provincial cities and towns, it was willing to do so in the case of London, but pointed out that, differing from the provincial cities, the County Council was not the road authority, and that it could only do so if the County Council indemnified the company against any claims which might be made by the road authorities in the metropolis, and, as regards tariffs, it respectfully declined to discuss the impossible proposition submitted to it, but offered to agree to fix the company's present tariffs as the maximum charges to be made, and to come under an obligation to supply all intending users equally and without undue preference. On May 19, 1898, the County Council broke off the negotiations. The position may, therefore, be summed up as follows: Twelve months occupied in negotiations, finally resulting in a bargain being arrived at; further 12 months occupied in preparing a formal document to give effect to the bargain, finally resulting in the County Council withdrawing from it.

"On the 3d inst. there were 992 people in London waiting to be joined up to the company's system. As regards the bulk of these, they will have to wait an indefinite time, on account of the difficulties in the way of the company in physically connecting their premises with its exchanges, owing to the want of facilities which it is in the power of the County Council to give.

"Whether it is or is not desirable to import competition into such a service as that of the telephone appears to the company to afford no reason why the company should be denied facilities for doing its work. Even if competition is set up, it must, in the nature of the case, take years before it can meet fully public requirements, and in the meantime the public suffers and blames the company for not doing the impossible.

"I see that it was stated in the course of the debate that the highways committee is prepared to recommend the requisite facilities being given to the company, if the company will concede to London similar terms as to tariffs and wayleave payments as the company has given to Manchester, Liverpool and other towns. The position of London is not comparable with that of any other town. It covers an area of 634 square miles. The working cost of a telephone system throughout this great area is nearly double what it is anywhere else, and the tariffs must therefore be proportionately higher. At the same time I may add that the company is considering whether it cannot meet the requirements of small users and those requiring a more limited service.

"It is the intention of the company to invite the County Council to reopen negotiations, and it will not be the fault of the company if a proper arrangement is not come to. Let me give one instance of the treatment to which the company is subjected: When the bargain was concluded with the County Council on June 1, 1897, the company was allowed to go on with certain portions of underground work which were very urgently needed. Among the works authorized is a system of pipes for upward of 6,000 miles of wires, which the company has laid down in the districts governed by the Holborn Board of Works and the vestry of St. Giles, all centering upon a large exchange of the company situate at the corner of Holborn viaduct and St. Andrew street. These pipes are stopped close to the northwest corner of Holborn viaduct, and for months they have been lying idle, and, so far as can be seen, are likely to remain so, because the company cannot obtain from the local authority the permission to carry them across one road and into the exchange. In conclusion, I have only to say that it is not reasonable to blame the company for the deficiencies of its service if proper facilities are refused, and every impediment and difficulty placed in its way."

Extensions and Improvements.

W. H. Alley has been granted a franchise for a telephone system at Clinton, Mo., and he proposes to install a plant of 300 instruments. He has not yet purchased his equipment.

Messrs. Seufert and Condon will put in a telephone line to Prineville and immediate points, instead of the Oregon Telephone and Telegraph company, which contemplated a similar enterprise.

From Maine to Texas by telephone will soon be an accomplished fact over the longest line in the world. About 10 days ago the last wire was strung by which Austin was placed in telephonic connection with Bar Harbor. The line is said to cover a distance of 2,600 miles, and will be open to the public December 1st.

The New Rochelle and West Chester Telephone company was incorporated at Albany, November 23d, with a capital of $150,000, to maintain lines of telegraph and telephone in New Rochelle, and thence to Mamaroneck, Bridgeport, New Haven, Boston, Providence, White Plains, Yonkers, Albany, Buffalo, Ogdensburg, Rouse's Point and other cities, villages and towns in New York, Connecticut, Massachusetts and Rhode Island. The directors are George W. Sutton and Joseph Claudet of New Rochelle, Heinrich Meyer of New York city, John H. Scofield and David G. Whiting of Grand View, and Horace A. Conner and Frederick R. Kellogg of Brooklyn.

The Automatic Telephone company of New Bedford has been organized under the laws of Massachusetts, with a capital stock placed at $100 000 and the par value of shares $50. The incorporators include about 30 prominent men of New Bedford, Mass., who have elected the following-named officers: President, John W. Macomber, who is president of the New Bedford Safe Deposit company; vice-president, F. T. Akin of F. T. Akin & Co.; treasurer, Frederick Taber, vice-president of the deposit company; clerk, Arthur E. Perry of Knowlton & Perry; directors, the foregoing officials and B. F. Brownell, Lot B. Bates, Frank R. Kirby, Joseph Poisson and J. L. Gillingham. The company will commence the construction soon of a first-class underground telephone system, with private metallic circuits for each subscriber, and long-distance instruments, as soon as 500 subscribers have been secured.

During the last year or two great improvements have been made in apparatus for central telephone-exchange offices. The Newark Telephone company of Newark, N. J., has just installed a new central-office equipment that is pronounced by experts to possess new features of value. It does its work so rapidly that a great deal of time and money is saved, requiring fewer operators and at the same time giving better service. The Newark Telephone company is an opposition company, and, it is said, the success of its exchange equipment amazed the officials of the Bell company. This exchange is connected directly with 2,100 local subscribers, and also has connections with sub-stations, giving it a total of over 3,100 connections. As the rentals charged by the Newark Telephone company are much less than those charged by the Bell company, the citizens of Newark are to be congratulated on securing cheaper and better service.

Cling-surface for Belts.

Almost the entire amount of steam and water power developed is transmitted by belting. One-third, at least, of the power is lost in its transmission. This loss amounts to many millions annually. It is tremendous, and anything likely to cut it down must be of interest.

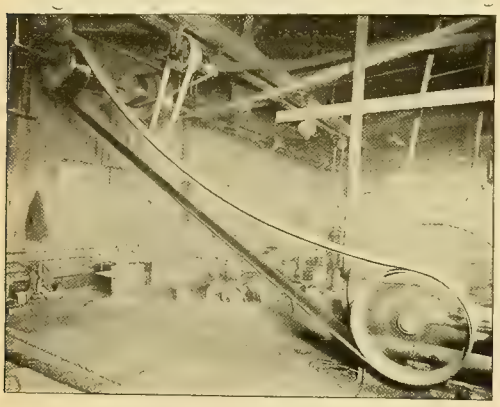
Leather constitutes two-thirds of the belting material. It is composed of interlacing fibers, and they are commonly dry. As the belt in use bends over the pulley, these fibers are constantly rubbing together; the friction so produced after a time wears out some of the fibers, the leather is weakened in spots and the belt cracks. A creaking boot-sole gives evidence of this. Again, the belt is stiff and hard, and as it does not conform to the pulley face it slips, its working surface becomes polished, and it slips more; then it is taken up, and, to save time, it is taken up as short as possible. This increases the strain on the belt, the friction on the bearings, and also wears the metal; this again increases friction, and so it goes, over and over again.

This holds good in a measure with a cotton belt. In a rope drive the friction is between the strands, augmented by the fact that they are hard twisted.

A good rubber belt ought to cling, but the present experience is, however, that it clings for a short time only, then the belt takes on a gloss, and one begins to look about for something to make it pull.

The stitched and painted cotton belts are good drivers for a time, but soon—too soon—they also take on a polish and slip.

Repeated tests have proven that the belt that will transmit the most power is one made of "patent leather." The reasons are obvious. Such leather is thin and soft, and conforms to the pulley; the surface is perfectly smooth and dry; no dust adheres to it; consequently it lies flat, with no air between



CLING-SURFACE FOR BELTS.

it and the pulley face. It does not adhere to the pulley; and, lastly, the patent-leather surface is clinging. It clings to the face of the pulley without sticking. A belt of this kind is, of course, not practical. It is too delicate.

With this picture before him the inventor of Cling-surface gathered together from as many practical sources as possible, and built up, after considerable laboratory work, a material that will produce and retain this patent-leather effect, and more, on a new or an old leather belt, on cotton, on rope or on a rubber belt.

With leather, cotton or rope it is likewise necessary to protect and lengthen the life of the fibers, threads or strands of which they are composed.

When Cling-surface is applied to, for instance, a leather belt (this being the most difficult to protect and keep in order) it is melted, and a very thin coating is laid on with a brush every day or two until the belt is full.

Then the fibrous leather has become filled with a neutral hydro-carbon that will not oxidize like a grease, nor evaporate like an oil; consequently, it will remain in the belt, surrounding the fibers, lubricating them, the same as if they were resting in an oil bearing. Such a belt cannot crack, and it is said that it will last a lifetime.

It is as soft almost as a piece of cloth, and yet it will not stretch; the soft, spongy portions of the belt are filled and become solid and firm, yet flexible. It is absolutely waterproof. Immerse a piece in water for two years and it will not become hard. It is oil-proof, for if an oily belt is treated on the inner side with it the oil will be driven out and can be wiped off, while the Cling-surface will take its place.

While this transformation is taking place in the belt, a clinging surface is being produced on its surface, as much like the patent-leather surface as it is possible to produce and retain on an oily background.

This surface is smooth and even. It is neither sticky nor smeary, and yet it is very clinging, so much so that slipping is impossible with such a belt, and it can run so exceedingly slack that, as the assistant superintendent of the Erie railway dry-dock says: "We believe we have saved the cost of taking up 500 belts in the past two and a half years." The illustration herewith presented illustrates one of the company's belts which had had no dressing on it for two months previous to the taking of the photograph.

When a belt is full it can hold no more. So only enough is necessary thereafter to keep the surface from getting dry.

Cotton belts and rope drives are treated in the same manner. As this inner treatment is not necessary with a rubber belt, the Cling-surface must be laid on thinly, and not so often applied.

The Cling-surface Manufacturing company, Buffalo, N. Y., after numerous experiments, although perfectly satisfied with the material, placed it in the hands of some 50 manufacturers for trial, to be applied to all kinds of belts, under all sorts of conditions, for a period of about 12 months before it was put on the market. The company states that the unanimous verdict was: "It is the best belt dressing we have ever used." Consequently the company guarantees that every pound of Cling-surface will give the purchaser complete satisfaction.

220-volt Enclosed Arc Lamp.

A perfected form of carbon-feed arc lamp for direct connection across 220-volt mains is being placed on the market by the General Electric company. It operates with 120 volts at the arc, takes a normal current of 2.5 amperes and, with one trimming, has a life of from 130 to 150 hours, requiring no attention during that time. The carbons are so proportioned that the upper carbon at the end of any run of 130 or 150 hours may be placed in the lower carbon holder for the next run. The light is of less volume and more violet in color than standard 110-volt lamps, but the advantages of a 220-volt lamp capable of independent operation sometimes compensate for the diminution of light as compared with five-ampere power circuit lamp for use two in series across 220-volt mains. A variable resistance at the top of the mechanism allows the use of the lamp on circuits of from 210 to 250 volts, and disconnection from the circuit is effected by a quick-break switch applied to each lamp.

The 220-volt lamp is weatherproof and may be used without a hood. It is especially suitable for lighting vestibules, doorways, window fronts, etc. It may be used with the closed outside globe, as shown in the illustration, or with the single globe and flared reflector. The casings are of several designs, the standard weatherproof casing being finished in black enamel.

A Central-station Expedient in Montpelier.

Electrical men will appreciate a recent exploit of the "boys" in a Montpelier (Vt.) central station. There are two electric-lighting companies in that city, and competition is very sharp. The new company has three 150-kilowatt alternators driven by water power. The old company has two 100-kilowatt alternators of modern construction, six arc dynamos and a job lot of old machines that cost a large sum a few years ago, but are not salable to-day. In this lot are three Thomson-Houston self-exciting alternators and a 500-light Heisler dynamo. These four machines had been moved out to make room for the new alternators, but the old switchboard and station instruments are still in place, the circuits being connected to the new machines. Two engines and five waterwheels, by the medium of a jack-shaft and belts, supply power for the street and interior lighting.

This was the situation in the old plant the day before the Legislature assembled for its biennial session of 1898. The men had been working night and day for two weeks, getting ready for the increased business, which included the lighting of the capitol buildings. The material had been late in arriving, so that, at the last minute, a circuit was connected to one of the alternators without being protected by circuit breakers, but fuses were substituted and everything connected for a trial run; the next night business would commence in earnest. Everything went well, and a tired lot of men congratulated each other. But about nine o'clock a wire fell across the new line, and the resulting short-circuit failed to blow the fuses, but did wreck the armature, so that it could not be repaired without sending it to the factory.

The three small alternators, together, had a sufficient capacity for the load of the disabled machine but there was room to belt up only one of them, and each of the four circuits had a heavier load than any one of the machines could handle. A hasty calculation showed that by running about two miles of wire another circuit could be formed and the load divided up so that the small machines could carry it, provided they could be belted up. The manager was well acquainted with the L. P. and D. system of belt transmission, and he found room for one dynamo between an engine and the jack-shaft; then, by moving an arc dynamo, and making the belt a few feet longer, there was just room to squeeze in the third machine. A trip to the L. P. and D. shops showed that that company had transmitters and split pulleys on hand of the size required.

The foreman reported several miles of wire not in use, that had formerly carried the Heisler current, but which had not been taken down, and said that he could take this wire down, string it on the poles of the proposed line and make the necessary connections ready to start up the next night.

The engineer said that he could move the machinery, set up and belt the transmitters and have his part ready; and the manager was to try his hand at wiring the machines to the old switchboard.

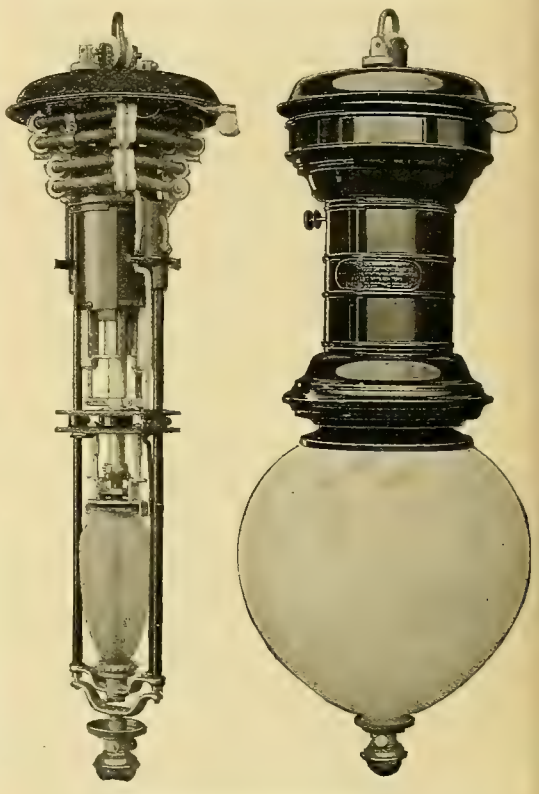
About 4:30 p. m. the next day all the circuits were started up, not a customer being left out, the capitol was lighted from dome to basement, and the governor's reception, the event of the session, was a grand success.

This interesting performance was possible because the employes were self-reliant and had faith in "a long pull, a strong pull and a pull altogether," and also by the use of the L. P. and D. system, which makes it possible to run the driven and driving pulleys close together, utilizing space that would not be available with any other method of driving.

In belting up the machines no lacings were used, but all belts were made endless, as the engineer is supplied with a kit of belting tools, and many a dollar is saved by repairing and building up belts that otherwise would be thrown away.

The central-station company referred to is now engaged in developing a water power at Bolton Falls, on the Winooski River, 17 miles below its present plant.

The equipment will consist of two 450-kilowatt General Electric direct-connected generators of the revolving-field type, which generate current at 12,000 volts. The line is to be of bare copper, and



220-VOLT ENCLOSED ARC LAMP.

step-down transformers will be used at the existing station to adapt the current to the present lines.

Electrical Show in New York Next Year.

At the annual meeting of the stockholders of the Electrical Exhibition company of New York, held on November 21st, it was unanimously decided to hold another electrical exhibition in that city in 1899. The following-named officers and directors were elected: President, C. O. Baker, Jr.; vice-president, F. W. Roebling; secretary and treasurer, George F. Porter; general manager, Marcus Nathan; directors, H. H. Harrison, L. F. Requa, J. W. Godfrey, C. A. Lieb.

The annual meeting of the National Electric Light association for 1899 will be held in New York in May or June, unless the executive committee determine otherwise.

The Siemens & Halske company has just obtained the contract with the city of Vienna for transforming the street railways into an electric system of nearly 120 miles. The firm has, according to the Vienna correspondent of the London Economist, entered into agreements with the German and Austrian governments to experiment with electric power on standard-gauge roads, in Germany on the Berlin-Wannsee line, and in Austria on the new city railway. The elevated electric railway which the firm is building there will be the first of its kind in Germany. It is interesting to note that the houseowners in the streets occupied by this line have already begun to express opposition to the project, fearing that it will injure their property. It will be recalled that the Manhattan Elevated Railroad company of New York had to encounter long litigation from property-owners who claimed damages, and that in the course of this litigation it was shown that real estate in the streets used was, in fact, increasing in value.

CORRESPONDENCE.

New York Notes.

New York, November 28.—Street-railway service in this city and vicinity—all through the Eastern and Middle States in fact—was badly crippled by the unusually severe snowstorm of Saturday and yesterday. Trolley lines in the great area of the city of New York were "tied up" for varying lengths of time, from early in the evening of Saturday until late last night. In many instances the superintendents were unprepared for the storm, although the Weather Bureau gave warning of it, but so great a depth of snow fell during the storm that it would have been impossible for any company with ordinary resources to have maintained uninterrupted service with any degree of preparation. There were great drifts of snow in the streets, and many of the attempts to make way with the snowplows were unsuccessful. The storm is generally considered the most severe since the memorable blizzard of March 12, 1888. It gave a severe test to the new conduit electric railways in the borough of Manhattan. For several hours between midnight of Saturday and noon of Sunday travel was practically suspended on these roads. The snow came down so fast that the electrically propelled snowplows and sweepers were not equal to the task of keeping the tracks clear. On the cable roads better progress was made with the snowplows, but, on the other hand, when a grip broke under the strain, the cars could not move backward and a bad blockade resulted. During the storm the Metropolitan Street Railway company had over three thousand men at work and a great number of appliances for handling the snow. On the cable lines alone there were twenty sweepers constantly at work, besides "walkaways" and snowplows. The telegraph and telephone service was also seriously retarded by the storm. The damage to the electrical and street-railway companies in and near New York, in injury to plant, loss of business and extra labor must amount to a large sum of money.

Alfred Skitt has been elected vice-president of the Manhattan Railway company and will, it is said, relieve Mr. Gould of the details of the general business management of the system. Mr. Skitt has had extended business experience and was at one time superintendent of the Fourth Avenue street railway. He has been long associated with the Vanderbilt interests. His election is looked upon as a desirable "infusion of new blood" and had a favorable effect on the price of the stock. Some persons profess to see in it an augury of the long-promised change of the motive power of the lines from steam to electricity. It is believed that for many months engineers have been at work on plans for the electrical equipment of the elevated roads, these plans contemplating not only the fitting-up of the rolling-stock for electrical propulsion and the lighting of the cars by electricity, but also the building of electric elevators at stations; and the public announcement of these plans, it is once more asserted, will before long be made.

The commission to revise the patent and trade-mark laws of the United States concluded its hearing in this city last week. Among the patent attorneys who addressed it was F. P. Fish, one of the counsel for the General Electric company.

A batch of applications for street-railway extensions and connections in Harlem was made to the Board of Aldermen and the Council last week on behalf of the Third Avenue Railroad company and the Metropolitan Street Railway company. It is understood that the two companies have agreed to a division of the streets over which their tracks are to run and that there will be no opposition from either to any of the applications. All the applications were referred to the railroad committee, and a hearing was fixed for next Friday.

Thanksgiving Day was marked by the home-coming of the First Volunteer Regiment of Engineers, in command of Col. Eugene Griffin, who returned to Porto Rico to come home with his regiment. The transport Minnewaska, with the men on board, came up the harbor in the middle of the day, and the soldiers did not set foot on shore till Friday morning, when they were marched to the Eighth Regiment Armory, where a belated Thanksgiving dinner was provided for them by the Society of New England Women. In the afternoon, after dinner, the men were paid off and sent home on furlough. Before leaving the armory there was a display of good feeling on the part of the men toward their officers. Colonel Griffin and the officers were cheered and each had to make a speech. The colonel thanked the women who had furnished the dinner, and, turning to his men, thanked them for their devotion, excellent discipline and display of kindly feeling toward him and the other officers. The engineers were very cordially received by the people in the streets through which they marched. The regiment was too late to take part in any fighting, but did some engineering and construction work in the neighborhood of Ponce and Guanica. Most of the men were in excellent health, but the change in climate was very noticeable to them. Lieutenant R. V. Beach, who died some time ago, was the only officer lost. Of the 1,097 men and 48 officers who went to Porto Rico, 857 men and 47 officers returned on the Minnewaska. M. S.

New England News.

Boston, November 26.—In the office of the post-office inspector in this city there has been installed for experimental purposes a miniature system illustrating a proposed electric signal for the city-collection boxes, similar in purpose to the police-patrol signal system. The plan is to connect all the street letter-boxes with the central postal stations of the district, so that collectors will have to open the boxes on their various routes in regular order, the station being informed by the ringing of a bell whenever a box is opened. At the same time the exact minute when the key is turned in the lock is registered on a dial in the station. If the system operates as it is claimed it must, it will be impossible for collectors to skip boxes along their routes, and it will also be impossible for any unauthorized person to tamper with the boxes without giving a warning to the central office. If the system is adopted and installed there will be a switchboard at every carriers' station, with a man in charge. When a collector starts out the pressing of a button will cause a tumbler to fall in the lock of the first box he is to open. The turning of his key in the lock of that box will register his arrival and repeat the process with the tumbler of the next box on his route. If a box is skipped the boxes beyond it cannot be opened.

Among the propositions to come before the next session of the state Legislature is one that is likely to provoke considerable opposition, for it not only antagonizes the steam railroads in a very vital particular, but it is an innovation of sweeping character that may meet with decided disapproval at the hands of municipalities and citizens in general. It is embodied in the following petition: "The undersigned petitioners, citizens of Massachusetts, respectfully represent that they desire to be made a corporation, under the name of the Massachusetts Electric Freight company, for the purpose of transporting freights over the electric railways of Massachusetts, and, to further this end, that said corporation be authorized and empowered to contract with any and all electric-railway corporations in Massachusetts for the use of their tracks and wires, for the purchase of electric power and for the hauling of freight cars owned by the Massachusetts Electric Freight company, and also to be authorized to make such use of the locations of the electric railways as may be necessary to carry on the business of transporting freight over said railways, subject to such provisions of law as may be deemed expedient." This document bears the signatures of James Means, Archibald M. Howe and Andrew Fiske, all well-known Massachusetts men with money at their command.

The first street work in connection with the construction of the Boston "L" road has been begun in the Bunker Hill district. The work in hand is in City square, and contiguous to the terminus of the new bridge to Boston from that section of Charlestown. The contract has been let for the elevated structure that is to cross this bridge, and it will be speedily connected with the structure in the square when the bridge is completed. The work of setting the posts northward through Main street from City square will be pushed steadily from now on.

There was an interesting competition for horseless carriages early in the month at the Charles River bicycle-racing park in Cambridge, the contestants including two companies manufacturing electrically propelled vehicles. There were three events, and the competition was under the auspices of the Massachusetts Charitable Mechanic association, which is holding its triennial fair this fall in Boston. Money prizes were offered to the amount of $1,100, the sum of $500 being for the winner in the speed contest. No electric vehicles were entered in this event, but a stanhope phaeton, made by the Riker Electric company of Brooklyn, captured the honors in the second event, the contest on brake efficiency, and with them a prize of $100. The Riker vehicle took second prize, $50, in the third event, a contest in manageability, the carriage being operated between posts and turning to come back. The Eaton Electric Motor Carriage company of this city participated in the competition, and a number of other well-known makers of automobile carriages who are exhibiting at the fair entered the lists.

An important sale of securities was consummated in Waterville, Me., last week, when the following transfers were made by Treasurer Libby of the Lewiston, Brunswick and Bath Street Railway company: To A. A. Blair, Boston, stocks and bonds stated at $25,000; to M. Bolles & Co., Boston, bonds, stated at $100,000; to J. Hugh Peters, New York, stock stated at $50,000 and bonds at $200,000. The road is one of the most important in New England.

One of the most prosperous electric street railways in this section is the one in Portland, Me., which pays a dividend this year of six per cent. and has a surplus of $33,391.

The Newport and Fall River Street Railway company has just declared its first semi-annual dividend, and will pay three per cent. for that period. The road has been in operation since June 19th, and up to November 1st earned net $20,897.

A new electric street railway is projected between Holbrook, Mass., and South Weymouth.

The Electric Club, a social organization composed of telegraphers in this city, met and dined at the United States Hotel on Tuesday evening of last week. The principal guest and after-dinner speaker was Thomas C. Boone of Springfield, who was the operator in the war balloon before Santiago, and he gave an interesting outline of the balloon's career before it came to grief at the firing line, where "it had been ordered, nobody knows why," by someone in authority.

One of the most singular uses to which a network of suburban street railways has ever been adapted was the campaigning tour of the Democratic candidate for Congress in the district embracing Lynn and other nearby cities. The start was made from Lynn in chartered electric cars, three in number, with brass band, representatives of the press, friends of the candidate, and an abundant supply of Roman candles, red fire and rockets. The candidate left Lynn at 6 p. m. and passed through West Lynn, Wakefield, Stoneham, Melrose, Malden, Everett, Chelsea, Charlestown, Revere, and back to Lynn, where he arrived at 11:30, after making speeches from the car and in halls in every town and city on the route. He was scheduled to arrive at 11, and this time could have been made, in all probability, but for an accident to a regular car, which had jumped the track in Everett and blocked the way for the triumphal statesman and his loyal supporters. By the time Lynn was reached the procession had been swelled to seven cars. The man who made this singular trip was Mayor Walter L. Ramsdell of Lynn. C. S. G.

Canadian Intelligence.

Ottawa, November 26.—Mr. C. J. Ballantyne of Honolulu, formerly a resident of Ottawa, is now in the city. He left Ottawa and went West in 1882, finally locating in Honolulu, where he entered journalism on the staff of the Hawaiian Gazette. Recently he organized a company and bought the franchise to operate an electric railway in Honolulu. He is now on a visit to the leading American and Canadian cities, with the object of purchasing a plant and also studying the systems upon which electric roads are operated. Speaking of Hawaii, Mr. Ballantyne said that the people were well satisfied with their status under American protection, and he feels sure that the country will progress at a much greater rate than previously.

On Friday of last week the shareholders of the Royal Electric company of Montreal met to consider the proposal of the directors to increase the capital stock of the company, which stock is now $1,500,000, by the issuance of 2,500 shares for the nominal value of $100 each, to be offered to shareholders, and also to effect loans by the issuance of mortgage or hypothecary bonds or debentures to an amount not exceeding in the aggregate 75 per cent. of the paid-up capital stock. The proposal, however, did not meet with the favor of the shareholders, and it was voted down by a majority of 932 shares.

The Metropolitan Electric company will be supplying electric light, power and heat to the city of Ottawa probably by the end of March next. The survey of the company's water power at the Britannia Rapids, about 10 miles from Ottawa, has been completed, and everything is now ready for the work of constructing the power house and arranging for the transmission of electricity. Tenders have been called for, and about the 1st of December operations will be started. The Metropolitan company has two lines under construction for the transmission of the electricity. Only one of these, however, will be operated at present. Through a point of land on the Ontario shore of the Ottawa River, which juts out into the Britannia Rapids, a canal, of about 125 yards long and 20 feet wide, will be made. At the foot of this canal will be built the power house, and the water from the rapids will be concentrated in the canal.

The Lunenburg Gas company of Lunenburg, Novia Scotia, is changing its electric plant from steam to water power. It has a 16-foot dam nearly completed on the Mush-Mush River at Mahone, eight miles from Lunenburg. The pole line is completed, and is said to be the finest in that part of Nova Scotia. The waterwheel is from the works of the S. Morgan Smith company, York, Pa. The company will light the town of Mahone, in addition to supplying light and power to Lunenburg.

The Ontario government will probably ask the courts to determine whether or no the Niagara Power company has forfeited the charter which it obtained from the provincial authorities. The agreement between the government and the company called for the development of 10,000 horse power by the 1st of November last and 25,000 horse power by a later period. The government takes the view that the company has not fulfilled the first of these conditions, and that it has therefore no further right to the charter. The company, on the other hand, points out that, under another section of the agreement, the charter was only to be forfeited in the event of a failure to transmit electricity. It claims that it has been impossible to comply with the latter condition, as, up to a very recent period, the problem of long-distance transmission had not been solved. Furthermore, the company says it cannot fulfill the contract to supply electric energy because there is no demand for it.

The Lachine Rapids Water and Power company is offering a reward of $500 for information which will lead to the conviction of a miscreant who on Saturday last threw a piece of iron hoop over the transmission wires of the company, at Montreal, near the city limits, causing the fuse to blow out at the power house at Lachine, and shutting off all the lights of the company in Montreal. This method of destroying the company's light service throughout the entire city is easy of accomplishment. The electric energy from the power house, which sup-

plies the different light circuits in the city, is carried to the city limits on two bare wires. By throwing a piece of iron hoop over these wires the entire plant was short circuited. W.

Northwestern Notations.

Minneapolis, November 26.—The city electric-light plant at Grand Forks, N. D., has been completed and is ready to be turned over to the city.

The city of Winona, Minn., has passed an ordinance requiring electrical inspection of wires. The city engineer is to do the work.

The council at Spring Valley, Minn., contemplates the substitution of arc for incandescent lights.

The Red Lake Falls Electric Light company has been incorporated at Red Lake Falls, Minn., with $10,000 capital. The plant is about ready for operation.

The electric-light company at Manchester, Ia., is putting in a gasoline engine to supplement its water power, which is insufficient to run the system.

Charles Rumsey has contracted to operate the electric-light plant at Whitehall, Wis., for the coming year.

The Electric Light and Power company of Fort Dodge, Ia., has let the contract for a 450 horse power engine to run the lights and stationary motors.

It is reported in Duluth, Minn., that the Interstate Traction company will build an electric line to Minnesota Point next season. The company now operates a horse-car line.

The Tri-city Railway company of Rock Island, Ill., has consolidated the Mount Ida and Northwest Davenport lines and will maintain a 15-minute service hereafter.

Vice-president Goodrich of the Twin City Rapid Transit company suggests that the power dam be used to furnish power to fill the reservoir for the water system in Minneapolis. The dam is furnishing more power than the company uses, and between 1 and 5 a. m., when the cars are stopped, the reservoirs could be pumped full enough to last until the next night.

The water department in St. Paul thinks its pipes are suffering from electrolysis. A main broke in the street, and when it was taken up the pipe was porous as a sponge.

A number of improvements have been made to the plant of the Polar Star Electric company at Faribault, Minn. The engine room has been enlarged, a new engine added, with boilers, etc.

The engine for the electric-light plant at Mora, Minn., was overtaxed, and, as a result, the piston rod and other parts broke. A new engine was on the way at the time of the accident.

The Electric Light, Heating and Power company of Grundy Center, Ia., has put in a new 80 horse power boiler, to be used in case of an emergency.

The new electric-light plant at Morris, Minn., is about ready for operations.

The recent blizzard had but small effect on the wires of the Western Union and North American telegraph lines in Minnesota. No interruptions of consequence were encountered.

The electric-light plant at Fosston, Minn., has been completed and turned over to the city.

The Electric Light company of Walla Walla, Wash., has refused to accept $5,000 a year for 60 arc lights, as proposed by the council. The company says that if it were accepted the rates to consumers would have to be increased to make up the deficiency.

The Cedar Falls and Waterloo Rapid Transit company is operating its cars in Cedar Falls, Ia., having rebuilt the line there.

The electric-light plant at Winterset, Ia., is said to be overloaded. At any rate, the users complain of the service.

It is rumored in Tacoma, Wash., that eastern capital is considering a plan to build a fast interurban electric line beteween Seattle and Tacoma. C.

PERSONAL.

Professor Wilhelm Conrad Roentgen, discoverer of the form of radiation that bears his name, has received the offer of a generously endowed professorship in the University of Leipsic. Professor Roentgen has taught in Strasburg, Hohenheim, Giessen and Wuerzburg. Since his discovery of the X-rays Professor Roentgen has been made a baron by the emperor of Austria.

An English contemporary notes the sad death of M. Meritens, the French electrician who designed the type of dynamo which is now employed in almost all electric lighthouses. Neglected and overwhelmed with debt in his old age, with no prospect before him but pauperism, his furniture seized and himself and his wife homeless, the old inventor became desperate. He and his wife determined to commit suicide, and carried their plan to a too-successful conclusion.

Colonel Henry Lee, one of the leading promoters of the American Bell Telephone company, died suddenly at his home in Brookline, Mass., on Thursday night, November 24th. He was 81 years old. He retired on December 31, 1897, from the banking firm of Lee, Higginson & Co., of which he was senior partner. He continued as manager with George C. Lee of the Union Safe Deposit vaults, and was actively engaged in literary pursuits up to the time of his death. He was born in Boston September 2, 1817, and graduated from Harvard in 1836. He had been an overseer of Harvard University for 30 years. A few years ago he published a book entitled "The Militia of the United States: What It Is and What It Should Be."

According to a cable dispatch from Berlin, Frank Knaak of New York is under arrest charged with lese majeste. Knaak was dining in a restaurant with a lady to whom he addressed remarks concerning the emperor, which were overheard and reported to the police. Frank C. F. Knaak is in the New York directory as a mechanical engineer at 130 Fulton street. He is not a member of the Engineers' Club, the Society of Civil Engineers or the Society of Mechanical Engineers, although the Berlin dispatches stated that he was a prominent engineer.

The following is a list of this year's recipients of the medals in the gift of the Royal Society of England: The Copley medal, known as the "blue ribbon of science," is awarded to the English astronomer, Sir William Huggins, for his eminent researches in spectrum analysis; the two royal medals are given respectively to the Rev. Dr. John Kerr, mathematical lecturer in the Free Church Training College, Glasgow, on account of his work in the domain of electrical physics, and to Walter Gardiner, Clare College, Cambridge, for botanical investigations; the Rumford medal, to Professor Oliver Lodge of University College, Liverpool, for researches in electromagnetic radiation, on the Roentgen rays and other electrical matters; the Davy medal, to Professor Wislicenus of Leipsic, for contributions to organic chemistry, and the Darwin medal, to Professor Karl Pearson of University College, London, for work in biology and statistics of heredity and kindred problems.

ELECTRIC LIGHTING.

A franchise has been granted W. R. Lee and others to put in an electric-light system in Northport, Wash.

The Bonham Electric Light and Power company has been incorporated at Bonham, Texas, with capital stock of $25,000, for the purposes implied in the name.

The trustees of Pasadena, Cal., are figuring on owning their own electric-light plant, and for that purpose have called for bids on six different sets of specifications. Bids are to be in by January 1st.

It is probale that Monrovia, Cal., will be lighted by electricity within a few months, according to the Monrovian Electrical Power company. At a recent meeting of the directors of the company, it was decided to go ahead and put in the plant as soon as practicable.

Sealed bids will be received by I. H. Robinson, city clerk of Stockton, Cal., until noon, December 13th, for the franchise for the construction and maintenance of poles, wires, etc., for the purpose of constructing and operating a general public electric-light, heat and power system. The Standard Electric company has applied for the franchise.

Among the many attractions at Jacksonville, Fla., during Gala Week, ended November 25th, were several elaborate electric-light displays. The most beautiful and attractive of these was that on the square tower of the city building, where were presented in letters made of incandescent lamps the words, "Enterprise," "Prosperity" and "Progress," on three sides of the tower.

The Navy Department, through the Bureau of Yards and Docks, is inviting sealed proposals until December 17th for extending the electric-light system at the New York navy yard. At the same time and place proposals will also be received for enlarging the wiring system at the same navy yard. Specifications, blank forms of proposal, a wiring plan and a general plan will be forwarded to prospective bidders upon application to the Bureau of Yards and Docks, Washington, D. C., or to the commandant of the United States navy yard, Brooklyn, N. Y.

The Interior Department, through the office of Indian Affairs, is inviting sealed proposals until December 20th for furnishing and delivering the necessary materials and labor required in the construction and completion of an electric-light plant at the Indian Industrial School at Mount Pleasant, Mich. Plans, specifications and instructions to bidders may be examined at the Indian warehouse, 1602 State street, Chicago, Ill., at the Builders and Traders' Exchange, Omaha, Neb., and at the school. Any additional information may be obtained upon application to W. A. Jones, commissioner of Indian Affairs, Washington, D. C.

ELECTRIC RAILWAYS.

An electric railway is under construction to run between Atlin and Discovery City, B. C.

An electric railroad is projected between Marysville, Magnetic Springs, Pharisburg and Richwood, Ohio. M. A. Wright is mentioned as interested.

The Chicago and Fox Lake Electric Railroad company, which contemplates building a cross-country line from Fox Lake to the lake shore, has been granted a twenty-year franchise for a right-of-way into Lake Bluff. The company wanted a fifty-year franchise in Scranton avenue, but this was not granted.

The Taunton and Middleboro (Mass.) Street Railway company is organized, with a capital stock of $50,000, to build an electric railroad from Middleboro to East Taunton.

The new electric road between the villages of Wayne and Northville, near Detroit, Mich., will be in operation as far as Plymouth, a distance of 10 miles, on December 10th.

Enoch H. Fudge, Benjamin Johnson and other capitalists of Chicago are said to be considering the feasibility of building an electric railroad from Lexington, Ind., through Hanover and Madison to Vevay, about 40 miles.

The right-of-way is being secured for an electric road from Ann Arbor to Kalamazoo, Mich. It will be a continuation of the Detroit, Ypsilanti and Ann Arbor railway, and when Kalamazoo is reached it will be only a short stretch to Chicago, thus making possible a continuous line from Detroit.

The Washington (D. C.) and University Railroad Company, which was incorporated at the last session of Congress, is authorized by the commissioners of the District of Columbia to issue $175,000 of stock for purposes of construction. The road is to be double-tracked and will be operated by electricity.

W. J. Loughridge, vice-president of the Belt Line Electric company of Lexington, Ky., and Dr. Bennett, president of the National Exchange Bank, are reported as interested in a project to build an electric railroad between Lexington and Richmond, Ky., 22 miles. The road would cross the Kentucky River at Clay's Ferry.

The Pittston and Scranton (Pa.) Street Railway company has been incorporated to build a line three miles long in Lackawanna and Luzerne counties. The capital stock is $75,000. The incorporators are James A. Steese, president; Charles H. Mullen, D. A. Dunlevy, Mount Holly Springs; Lane S. Hart and W. H. Metzger, Harrisburg.

A petition has been presented to the council of Astoria, Ore., for an ordinance giving Mr. Kuettner a franchise to construct and operate street-car lines and to erect poles for conveying electric currents for all purposes for which electricity is now or hereafter may be used. Mr. Kuettner is believed to represent the Astoria and Columbia River Railway company.

Mr. W. S. Hook, manager of the Los Angeles Traction company, has petitioned the City Council to advertise for sale a franchise for a double-track street railway over the following route: Winfield street to Sentous, Sentous to Eleventh, from Eleventh to Georgia, from Georgia to Twelfth, from Twelfth to Sentous, on Sentous to Eleventh, on Eleventh to Hoover.

Work has been commenced on the enlargement of the car-houses of the Oakland (Cal.) Railway company at Temescal. This is preparatory to the operation of the San Pablo line by electricity. The line is to be extended to the point where the Valley road is to cross San Pablo avenue, on the route to Point Richmond. The power plant will probably have to be enlarged.

Judge Taft, of the United States Circuit Court, has ordered the sale of the Zanesville (Ohio) electric railroad on January 3, 1899, at the company's office in that city. William Christy was appointed special master to make the sale. Suit was brought by the International Trust company of Massachusetts, on account of a default in interest. Over $300,000, principal and interest, is due.

The Belt railway of Washington, D. C., has been sold to Oscar T. Crosby, whose bid was $350,000. The sale was in accordance with a decree of the Supreme Court of the District of Columbia. The lines of the company consist of about 15 miles of track. The law requires the purchaser to equip the road with the conduit electric system within one year after the sale is ratified by the courts.

A Vancouver (B. C.) paper states that the British Columbia Electric Railway company has been handicapped by lack of machinery. The general manager states that an appropriation has been passed for the erection of a new modern brick power house with large direct-coupled units operated by slow-speed condensing engines. The new power house will have a capacity of 3,000 horse power and room for extension. Work will be commenced at once.

At the next meeting of the Engineers' Society of Western Pennsylvania, to be held in Pittsburg on December 20th, G. F. Greenwood, general manager of the Consolidated Traction company of Pittsburg, will read a paper descriptive of the new power house built by that company in Pittsburg. After the meeting the members in attendance will be invited to go out and inspect the power house and equipment.

On November 25th the City Council of Baraboo, Wis., granted a franchise to the Baraboo, Kilbourn and Devil's Lake Electric Railway company to use a street in that city. The line will cover a distance of

eighteen miles, and the work will be commenced early in the spring. The road will connect two of the most popular summer resorts in the state. The incorporators are J. P. Cottrell of Milwaukee, F. J. Butler of California and H. Grotophorst of Baraboo.

The Metropolitan Street Railway company of New York has placed an order for the bodies for 100 open and 100 combination open and closed cars, for delivery early next spring. Last January the company ordered, for experimental purposes, 25 of the combination cars, and it was owing to the success which these cars met that the additional order was given. The only change in the new combination cars will be the substitution of curtains for shutter blinds.

The new and rapidly growing town of Miami, Fla., the southern terminus of the new East Coast railroad, is to become an electric-railroad center. The branches thus far projected will extend to Cutler, ten miles south of Miami, and to Lemon City, five miles north of Miami. The roads will be of great benefit to fruit growers who are obliged to send their crops to Miami for shipment north by schooner and they will afford valuable means for bringing new settlers into that section.

The Chattanooga Tradesman says: "Twenty-one thousand dollars have been raised, and the electric car and motor company is almost assured for Pine Bluff, Ark. Henry C. Wood, the Chicago attorney, and Mayor Bell have succeeded in raising $21,000 of the required $35,000. Sixteen thousand dollars have been subscribed by the citizens and $5,000 by Colonel Fordyce. The full amount of the cost of construction will be about $120,000. The Westinghouse company of Chicago will furnish all of the amount over $35,000."

A Baltimore syndicate formed by Middendorf, Oliver & Co., has bought out the Atlanta Railway company. The bonds of the company, amounting to $300,000, and the capital stock of $300,000, have been purchased. The company has 18 miles of track, and recently obtained a franchise to build 10 miles of additional track, reaching important suburban points. It is the purpose of the new owners to improve the property and complete the additional 10 miles by April 1, 1899. The company will be reorganized, with authority to issue $600,000 of bonds and $1,000,000 of stock. Of the bonds $500,000 will be issued and the balance held in reserve.

At a recent meeting of the City Council of Beaumont, Texas, a franchise was granted to E. L. Bacon, J. C. Ward and others who might be associated with them in the incorporation of an electric street-railway company to construct an electric street railway of not less than three miles distance through the streets of Beaumont, work to be begun within six months from November 1, 1898, and to be completed two years from that date.

The Hatboro (Pa.) Railway company is reported incorporated with a capital stock of $30,000, to build an electric railroad from Hatboro to Willow Grave. The incorporators are James McGregg, Samuel J. Garner, James Van Horn, James W. Rusling and R. Ashurst, Philadelphia, Pa.

The Metropolitan Railroad company of Paris is about to begin the construction of 33½ miles of underground electric roads, consisting of two lines east and west and two lines north and south, with a circular line through several of the principal boulevards. It is expected that a part of this will be completed before the exposition of 1900. If the plans are carried out, there will be an expenditure on the work during the next 10 or 15 years of nearly $40,000,000. It was at first proposed to build the lines by contract, but the city has now undertaken the work, and it is expected that a saving of about 17 per cent. will result. The trains will be composed of four to six cars each, one motor car to two trailers, and will accommodate two to three hundred passengers each. The expected speed is 22½ miles an hour between stations. The fare will be uniform for any distance, as on American street railways, and will be five cents for first-class and three cents for second-class. The lines will be leased for 35 years to a company with a capital of $5,000,000, which will furnish the contract, power plant, rolling stock, etc. It is estimated that the expenses of these installations will be between $10,000,000 and $12,000,000. The company will pay over to the city of Paris one-half of its gross receipts, and in order that there may be a profit the cost of working must be less than half of the gross receipts, and the expenses will not be met unless the traffic reaches 150,000,000 to 180,000,000 passengers. Beyond this number there will be a profit, which will increase rapidly with the increase in the number of passengers.

TELEGRAPH.

At the meeting of the Cuba Submarine Telegraph company in London last week the chairman, C. W. Parish, referring to the cutting of the cables off the province of Santiago de Cuba by the Americans, said he had requested the assistance of the Foreign Office to obtain compensation from the United States. The Foreign Office, he added, had promised to do its utmost to assist the company, but it was pointed out that it was doubtful if the claim would be admitted.

ELECTRICAL SECURITIES.

The Detroit correspondent of the Western Electrician announces that the management and ownership of the electric road running from Detroit to Trenton, a distance of 12 miles, has been changed. The new owners will be R. T. Wilson of New York, Tom Johnson of Cleveland and others who hold stock in the Detroit Citizens' Street Railway company. It is said the road was sold by the Hendries to raise money to build a double track from Detroit to Pontiac.

A deed of trust has been recorded at Lynchburg, Va., from the Lynchburg Electric Railway and Light company, conveying to the State Trust company of New York, trustee, its franchise and all its property for the purpose of securing the payment of $150,000 of bonds, which it is proposed to issue, the money to be applied to the furtherance of the plans of the company in the rehabilitation of its street railroad at Lynchburg. The bonds will be 150 in number, the denomination of each will be $1,000, and they will extend from January 1, 1899, to January 1, 1934. In the case of default in the payment of the interest, which is to be six per cent., payable semi-annually, the trustee is authorized to sell the property and after the payment of certain necessary expenses to apply the proceeds to the liquidation of the bonded indebtedness.

PUBLICATIONS.

The Western Electrical Supply company of St. Louis issues a convenient price-list of the well-known Ship carbons made by Schiff, Jordan & Co. of Vienna and Nuremberg.

A recent catalogue of the Cincinnati Milling Machine company describes the improved Universal cutter and tool grinder manufactured by that company. The character of the tool and the work that can be done with it are very clearly shown.

The season of calendar distribution has begun. One of the earliest advertisers in this field is the Swarts Metal Refining company of Chicago, which has issued an attractive calendar for the coming year, neat in appearance and occupying but little space.

The Westinghouse Machine company and Westinghouse, Church, Kerr & Co. send out a neat booklet entitled "A Birdseye View of Our Business." The steam and gas engines and other machinery built and installed by these companies are called to attention.

The latest of the Electric Storage Battery company's illustrated circulars describes the installation of chloride accumulators in the Commercial Cable building of New York. The battery auxiliary in this plant consists of 120 cells. One dynamo runs from 9 a. m. to 9 p. m., and for the other 12 hours the battery carries the entire load, furnishing on an average 1,100 ampere-hours at 240 volts.

The Electric Appliance company's new catalogue of telephone apparatus and telephone-construction material is being well received by the telephone trade, and, judging from the orders for telephone material that are being received, it is being extensively used. The Electric Appliance company claims that it has the most complete catalogue of telephone supplies that has yet been issued. It will supply copies, free of charge, to the telephone trade.

The Purdue Exponent, the college weekly of Purdue University of Lafayette, Ind., made an "electrical number" of its issue of November 23d. The electrical equipment of the institution is described and illustrated, and there are a number of brief, interesting technical and semi-technical articles. One excellent feature is a practical address on "The Training of an Electrical Engineer," delivered by Professor W. E. Goldsborough before the Electrical society. The young men who heard it ought to have been benefited by it. Some interesting statistics of the 144 alumni of the electrical engineering school are given. One hundred graduates are known to be engaged in various kinds of electrical work. Calculating the financial returns, this statement is made: Nine per cent. of the alumni are making over $1,800 a year; 17 per cent. are making over $1,500; 34 per cent. are making over $1,200; 48 per cent. are making over $900 and 80 per cent. are making over $600 annually.

Bulletin No. 12,001, issued by the Western Electric company of Chicago, contains elaborate illustrations and complete descriptions of the S. K. C. inductor generators. These machines are made for single-phase, two-phase and three-phase current and for high or low voltage, and the advantages claimed for them are that they have no moving wire, no commutator, no collector rings, no brushes and no sliding contacts of any kind; no compound winding, no mechanical strain on armature wire and no balance of load are required; it is no trouble to wind machines for high voltage, therefore no step-up transformers are required, except for circuits above 12,000 volts, and any standard machine can be wound for single-phase, two-phase or for three-phase; the insulation is fixed and permanent, and all parts of machine readily accessible; there is close inherent regulation, independent phase regulation at the machine or switchboard, involving no loss; they are made for belt driving or direct connection to engines or waterwheels; they require small exciting current, and all machines have self-oiling and self-aligning bearings. The Western Electric company is the exclusive western agent for all apparatus manufactured by the Stanley Electric Manufacturing company. Bulletin No. 12,001 will be mailed to any one who has not received a copy.

MISCELLANEOUS.

The gentlemen interested in the Oldbury Electro-chemical company have organized a new company, which will erect a new plant on the Niagara Falls Power company's lands, east of the present plant of the Olbury Electro-chemical company, and will use 800 horse power, the contract for which was signed November 22d. The buildings for the new plant will be of substantial character, and will be commenced at once, the contract calling for delivery of power by March 1, 1899.

Official notice is being published in the Canada Gazette that the Canadian Power company will apply to the Parliament of Canada, at its next session, for an act to extend its time for the completion of its works, to extend the bonding powers of the company and to more particularly define its powers and to change its name. This company should not be confounded with the Canadian Niagara Power company, which has exclusive rights in Queen Victoria Niagara Falls Free Park, and is controlled by the Niagara Falls Power company. The two men who are prominent in the Canadian Power company are Banker Paine of Niagara Falls, Ont., and A. C. Dennison of Philadelphia.

TRADE NEWS.

The Wybro & Lawrence company of Los Angeles has filed amended articles of incorporation, changing the name to the Western Electric Works.

It is rumored at Bay City, Mich., that a number of the large lumber dealers, those who control the remaining forests in Upper Michigan, have formed a combination to increase the price of telegraph and telephone poles.

There is pending in the United States Circuit Court at Boston a suit brought by the Electric Storage Battery company against the Hatch Storage Battery company. The plaintiff seeks an injunction restraining the defendant from constructing, selling or using certain patented improvements for making secondary batteries, and also secondary battery elements or any part of them.

The Varley Duplex Magnet company of New York, which has been represented in the West so energetically and with so much success by J. Mason Knox, has moved its western office to 700 Fisher Building, Chicago. Mr. Knox is just recovering from an attack of illness, and during his disability he was assisted by J. Barry Farrington of the New York office. Messrs. Farrington and Knox make a "team" that is hard to beat.

The Emerson Electric Manufacturing company of St. Louis, Mo., has recently completed, and is ready to furnish, a device by means of which large church organs can be operated satisfactorily with the use of alternating-current motors. This special adaptation of alternating-current motors has been worked out in response to numerous inquiries, extending over a number of years, and the company believes that it is the only device on the market by which churches placed beyond the reach of direct current can operate their organ bellows with an electric motor. Printed matter describing this device is now in course of preparation, and will be ready for distribution to those interested within a short time. In the meantime the Emerson company will be glad to receive inquiries from interested persons, to whom it will send blue-prints and give all information.

A pleasant celebration to mark the opening of the new factory of the Warren (O.) Electric and Specialty company was held on the evening of November 22d. The relations of the company and its employes are very harmonious, and to "dedicate" the new building the company gave a dinner in it to all its employes. About 130 persons sat down at the tables when the day's work was finished. President T. H. Gillmer made a little speech, showing that in its six years of life the company's force had grown from six to 128 persons. He referred appreciatively to the pleasant relations of employers and employed and hoped they would continue. Three cheers were given for the company and its officers. The evening was spent in dancing. A feature of the proceedings was the yell of the Anti-trust football team, as follows:

Win we will, win we must,
For we belong to the Anti-trust.
Rah! Rah! Tiger! Sis-boom-bah!
W. E. S. Company—Rah! Rah! Rah!

BUSINESS.

Berthold & Jennings of St. Louis, dealers in poles and cross-arms, are said to be doing a large busi-

ness. The firm is noted for the excellence of its products.

The G. and P. Engraving company of Boston, which manufactures a high grade of name plates, is presenting a souvenir to each of its customers, in the form of a handsome paperweight.

The Farr Telephone and Construction Supply company, Chicago, is doing its utmost to keep up with the demand for its telephones and supplies. The company is having a run on its high-grade magneto bells, which, it is said, are being sold at a price within the reach of all. All those interested will do well to write the company for a copy of its latest catalogue.

K. McLennan & Co., manufacturers of Gale's commutator compound, are doing a flourishing business. The demand for this useful article is steadily increasing, and at the present time shipments are being made all over the world. The company has just shipped an order to Japan and has received word that the compound has been adopted by the telephone company of Dublin, Ireland.

The Berlin Iron Bridge company of East Berlin, Conn., is erecting for the Waterbury Manufacturing company, Waterbury, Conn., a new blacksmith shop two stories high. The building is to be of fireproof construction throughout. The floor consists of concrete on corrugated iron arches, carried by steel beams and columns. The roof has steel trusses supporting the covering of corrugated iron lined with the Berlin Iron Bridge company's patent anti-condensation lining. The building is about 40 feet square.

The Warren Electric Manufacturing company of Sandusky, O., is doing an excellent business. Beside the recent sale of three large machines to Armour & Co. of Chicago, late orders are reported from Fremont, Ohio; Seabright, N. J.; Mishawaka, Ind.; Elkhart Lake, Wis.; Columbus, Texas; Torreon, Mexico; Lerdo, Mexico; Huron, Ohio; North Baltimore, Ohio; Upper Sandusky, Ohio; Bowie, Texas; Martinsburg, W. Va.; Towanda, Pa.; Shelby, Ohio; San Angelo, Texas; McKinney, Texas; Fredonia, Kan.; Paragould, Ark.; Waco, Texas; Newport, Pa.; Auburn, Ind.; Charlestown, W. Va.; St. Louis, Mo.; Whiting, Ind.

The advertising novelties of the American Electrical Works of Providence are always clever, and the Thanksgiving reminder of this year ranks with the best that have been sent out. On a three-part folded card are pictures of a turkey ready for roasting and of other Thanksgiving dainties. Beneath the picture of the fowl a small wooden case is attached to the card. "The point is within" is the legend below it. On opening the case one finds a large threaded needle. This is the company's explanation of it all: "Of course we couldn't send you a real mince pie or a real turkey, but we do send a real basting needle all threaded for sewing up the turkey. (See the point?) Our best wishes for an enjoyable day. By the way, there's another point we want to mention—wire, both bare and insulated. You know who makes the best; no need for us to say more."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued November 22, 1898.

614,453. Method of Manufacturing Electric Cables. Sebastian Z. de Ferranti, Hollinwood, England. Application filed December 28, 1897.

The method of manufacturing electric cables for electric light and power distribution consists in first forming a circular standard conductor, compressing the conductor to the shape of a part of a circle in cross-section, insulating the conductor, and lastly laying a number of such conductors together, forming an approximately cylindrical cable.

614,462. Commutator. John R. Grindrod, Lynn, Mass. Application filed February 6, 1897.

This commutator is composed of a number of segments separated from each other by insulation, and provided with means whereby they may be secured to the shell; there is also an outer periphery for making contact with brushes, and means are provided for securing the segments in place during transit and mounting, but which is removed before the commutator is used.

614,472. Potential Switch. John D. Ihlder, Yonkers, N. Y. Application filed August 5, 1897.

This device is an electromagnet, the core of which is wound with a coil in series with the main-line circuit and a shunt main-line coil in opposition to the series coil, a switch lever controlled by the magnet, and a short circuit for the armature of the motor, the switch lever being arranged to close the short circuit of the armature when the main-line circuit is broken through an abnormal rise or fall of potential in the circuit.

614,474. Transformer Stamping. Dugald C. Jackson, Madison, Wis., and William B. Jackson, Grand Rapids, Mich. Application filed September 27, 1897.

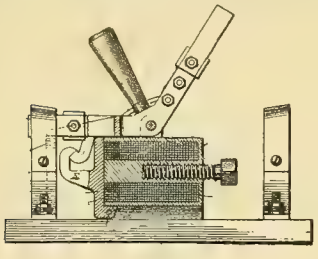
A transformer core may be built up of strips of sheet metal, some of the strips being folded on themselves and some not folded.

614,484. Hanger for Electric Lamps. Junius E. Mayo, Belvidere, Ill. Application filed June 16, 1898.

Two plates are hinged together to form a sheave case, each having a trunnion bearing therein; a sheave is mounted in the sheave case and a circular cap is provided with an upwardly projecting tubular suspending lug having trunnions thereon adapted to enter the trunnion bearings in the sheave case.

614,494. Fire and Burglar Alarm. James L. Norris, Washington, D. C. Application filed August 20, 1898.

Provision is made for a number of radially arranged explosion tubes or small cannon, of a ring fuse connecting their touch-holes in common and having a number of ignition terminals extended in different directions and provided with damp-proof caps.



NO. 614,472.

614,528. Electric-lighting Gas Burner. John M. Anck, Philadelphia, Pa. Application filed October 19, 1897.

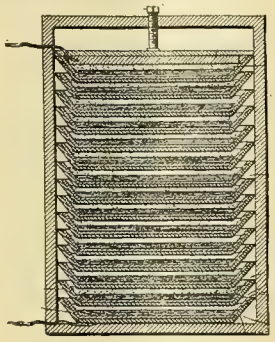
This attachment comprises a fixed electrode, a valve stem, a plate mounted on the stem, a lever also mounted thereon, insulation interposed between the plate and lever and between the lever and stem, an electrode carried by the lever, a lever pivoted to the plate, the pivoted lever being normally out of electrical contact with the electrode lever, and means for closing the circuit between the electrode lever and pivoted lever.

614,539. Secondary Battery. Nathan H. Edgerton, Philadelphia, Pa. Application filed September 14, 1897.

A series or pile of pans is placed substantially parallel with each other, each pan being formed of two dissimilar metallic electrodes in contact forming a couple, one side of each pan being an oxidizable metal, and the other side thereof having adjacent thereto an active material capable of further oxidation, the similar faces of the pans facing in the same direction, and a moisture-absorbing material placed between the adjacent sides of neighboring pans for holding the electrolyte.

614,571. Transformer System and Apparatus. Adolph Müller, Hagen, Germany. Application filed July 30, 1897.

Two circuits are employed for carrying currents of different tension; a commutator is interposed therein; storage cells in the high-tension circuit are electrically connected in groups with the commutator and adapted to be charged in parallel and discharged in series when receiving current from, and charged in series and discharged in parallel when supplying current to, the commutator; a storage battery is always in circuit with the low-tension circuit and connected with the commutator.



NO. 614,539.

614,572. Method of and Apparatus for Treating Ores. Joseph G. McNulty, New York, N. Y. Application filed May 7, 1898.

The art of extracting precious metals from their ores, consisting in mixing pulverized ore with an electrolytic fluid, causing the mixture to flow from one level to another between adjacent electrode plates of opposite polarity, passing an electric current between the plates and vibrating the electrodes in a direction substantially at right angles to the plane of the electrodes for the purpose of preventing the polarization thereof.

614,575. Conduit and Electric-current Conductor for Surface Railways. Arthur Petzenbürger, Gross Lichterfelde, Germany. Application filed March 30, 1896.

In an electric conduit for railways there is a cover beam having longitudinal slots and cut-out portions to receive the electric wires and insulator supports respectively, the longitudinal bearing in the conduit supporting the cover beam away from the sides of the conduit to form slots, the resiliently supported insulators supported in the conduit in the cut-out portions of the cover beam, and the electric-current wires mounted on the insulators and supported thereby in the slots of the cover beam.

614,597. Means for Conveying Cables, Wires or the Like Through Underground Conduits. John Wrigley, Elmira, N. Y. Application filed June 14, 1898.

A flexible shafting is employed consisting of a closely wound wire coil; an auxiliary coil is tightly arranged thereon but wound in opposite direction and having a wider or greater pitch than the first-mentioned coil, and an implement at one end of the flexible shafting is connected with both of its coils.

614,608. Dynamo-electric Machine or Electromotor. Eugéne Cantono, Pavie, Italy. Application filed December 16, 1897.

This machine is constructed with the fixed and rotative members of its magnetic field movable toward or from each other to vary the air space, and with an elastic medium tending to widen the air space, so that the width of the space varies with the field excitation.

614,633. Electrolytic Apparatus. Friedrich A. Thum, Newark, N. J. Application filed February 8, 1898.

An element of an electrolytic series plant, consisting of a non-conducting frame, is adapted to hold the material to be treated, the frame being closed at one side by a removable plate of conducting material, and at the opposite side by a non-conducting foraminous material, such as muslin.

614,677. Switchboard Apparatus, Signal and Circuit. Thomas C. Wales, Jr., Boston, and Frederick L. Rhodes, Winchester, Mass. Application filed November 26, 1897.

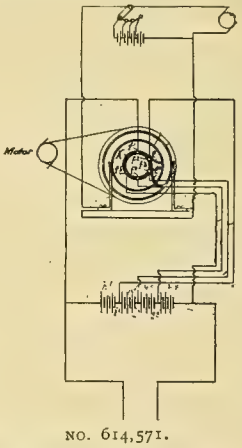
The system includes two main telephone circuits, each passing through a switch socket on a connecting switchboard to a switch socket and a self-setting and locking call annunciator on a terminal switchboard, and both provided with the customary associate test and signal-locking conductor, and a visual signal included therein at the terminal board; a station trunk circuit terminating in a switch plug at the connecting board, and having switch sockets in multiple at the terminal boards respectively, and the customary associate test conductor branching to switch contacts in the sockets; a link connection with a bridged disconnecting signal at each terminal board, having a switch plug at each end to connect with the switch sockets of the main and trunk circuits respectively, and an associate conductor uniting contacts on both plugs which register with similar associate conductor contacts in the main and trunk-circuit switch sockets; and a signal and test circuit including a battery having one of its poles connected with the main-circuit and link-connection associate conductors, and comprising a main conductor containing a plug-seat switch at the connection board controlling the entire circuit, and a plurality of branch conductors, one extending to a contact piece of the trunk-circuit switch plug and completed when the plug is placed in the connecting-board socket of a main circuit, through the associate conductor of the circuit, a second to a signal controlling relay and the associate conductor of the trunk circuit, and completed when the link-connection plug is in a terminal-board trunk socket through the associate conductor thereof, and a third through the circuit-controlling points of the relay and the supervisory signal controlled thereby at the connecting board.

614,686. Magnetic Cut-out. Leonard Andrews, Hastings, England. Application filed November 29, 1897.

A magnetic cut-out for each of two or more electric-current generators is described, consisting of a core surrounded by a continuous winding in series with the generator, a shunt winding part of which is in the same direction as the series winding and the other part in the reverse direction, and a switch controlled by the core.

614,759. Galvanic Battery. Charles T. Richmond, Cleveland, Ohio. Application filed July 18, 1898.

In a galvanic battery there is claimed the combination of a jar and a cover therefor made of insulating material, and having an integral threaded boss on its under side and a hole through the boss and cover, with a clay porous cup internally threaded at its open upper end, which cup is screwed onto the boss, a carbon electrode in the cup, having a stem which extends up through the hole, and a zinc electrode having a stem which projects through a hole in the cover, and is supported by the cover, and depolarizing material in the clay cup.



NO. 614,571.

614,794. Circuit Breaker. William I. Crawford, St. Louis, Mo. Application filed August 23, 1897.

Essential features of this device are a vertical stem whereby the armature is suspended, a standard to which the stem of the armature is secured so as to swing from its upper end, and an adjustable clamp for connecting the stem of the armature to the standard between the head of the armature and the point where it is secured to the standard.

DESIGNS.

29,707. Removable Cap for Telephone Receiving Instruments. James J. Mulconroy, Philadelphia, Pa. Application filed May 7, 1898. Term of patent, seven years.

29,708. Attachment Plug for Electric Cut-outs. Albert P. Seymour, Syracuse, N. Y. Application filed October 12, 1898. Term of patent, seven years.

Western Electrician.
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The Paris Exposition of 1900.

By Francis E. Drake,
Director of Machinery and Electricity, United States Commission.

Though occupying only about one-half the area of the World's Columbian Exposition at Chicago, the Paris Exposition of 1900 will have great opportunity for the satisfactory presentation of the arts of peace. The location of the grounds is practically in the heart of Paris on both sides of the river Seine, and affords an unrivaled opportunity for providing comfortably for great crowds.

The great main gate of the exposition (Fig. 8) will be at the historic Place de la Concorde, and will be capable of admitting 65,000 people an hour. Scores of other entrances will be provided, so that each section of the city may be amply accommodated.

The general plan of arrangement and the location of the principal buildings are shown in the accompanying diagram, Fig. 7, page 325. On the south side of the river Seine the majority of the principal palaces and attractions will be installed. The Esplanade des Invalides, a rectangular tract lying immediately north of the Hotel des Invalides, will contain palaces devoted to the exhibition of general manufactures. This tract will be connected with the grounds on the north side of the river and the Champs Elysees by the magnificent new bridge of Alexander III., now under construction. From the Esplanades des Invalides to the Champs de Mars, along the left bank of the river, will be a row of official pavilions of the great nations, among which will be the building of the United States. Between the bridge of the Invalides and the Champs de Mars will be grouped the buildings devoted to the exhibits of the army and navy, and between the Champs de Mars and the river will be a building devoted to marine navigation and another containing the exhibits pertaining to forestry and fisheries.

On the famed Champs de Mars will be found the several great palaces of the exposition, in which will be housed practically three-fourths of the exhibits. They will be built around three sides of the rectangle and will be named as follows: Palace of Agriculture, Palace of Electricity, Palace of Machinery, Palace of Transportation and Civil Engineering, Palace of Textiles and Textile Fabrics, Palace of Mines and Metallurgy, Palace of Chemical Industries and Palace of Education and Liberal Arts.

The great Eiffel tower, which was such a conspicuous attraction at the Paris Exposition of 1889, will remain at the north end of the Champs de Mars, and no doubt will excite the same general interest among visitors to this great fair.

On the north or right side of the river will be found, beginning at the Place de la Concorde, in the order named, the two permanent art palaces, a section of Old Paris, Palace of Horticulture and Arboriculture, the Hall of Social Economy and International Congresses, and the Palace of the Trocadero and Trocadero gardens, where the exhibits of the colonies will be located.

At the park of Vincennes, eight miles distant, will be located an annex to the exposition proper, where the railway exhibits will be placed, also the automobile, bicycle and similar displays. At this annex provision will be made for international athletic sports, and, owing to the attractive character of the park, thousands of people are expected to visit this annex daily. Ample means of transportation from the exposition grounds will be provided both by rail and boat.

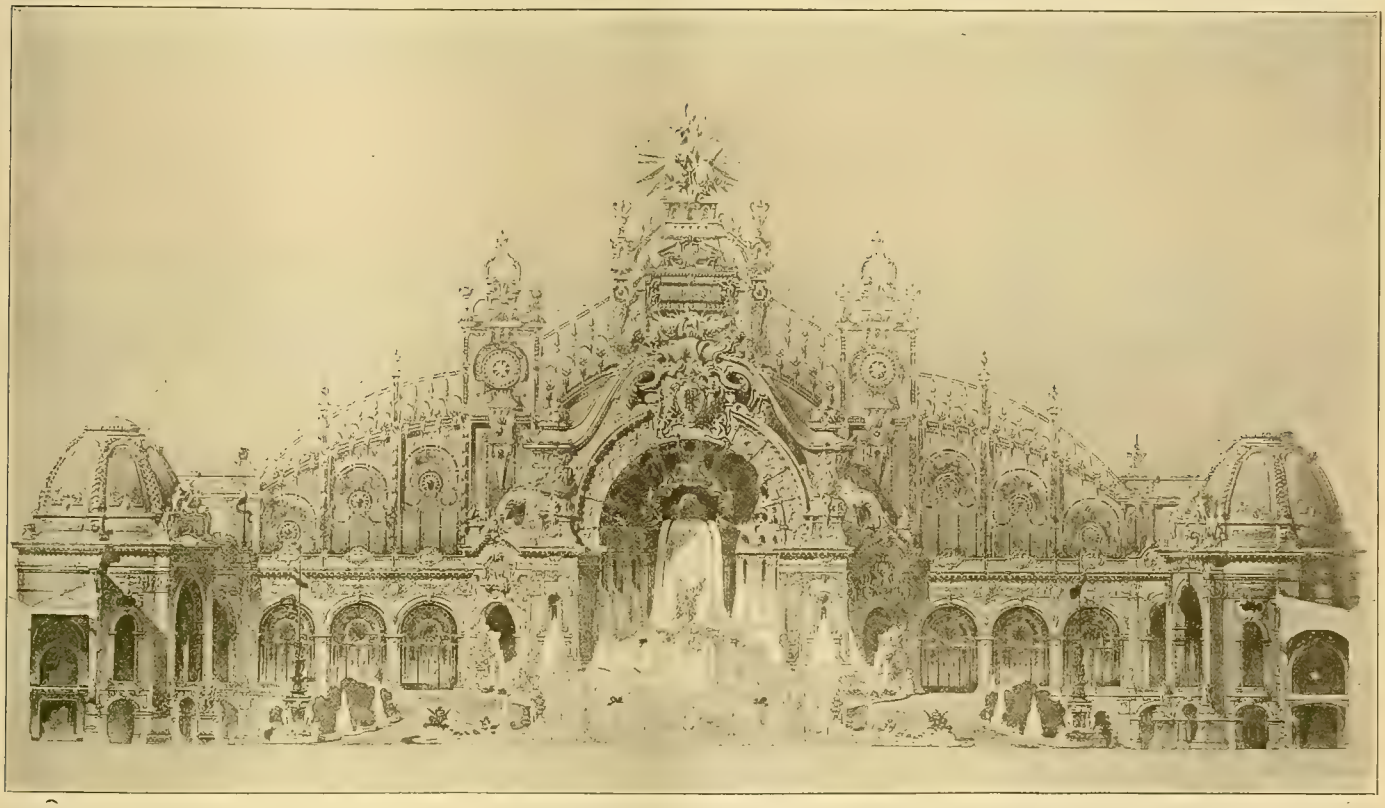

FIG. 1. THE PARIS EXPOSITION OF 1900.—PALACE OF ELECTRICITY.

Machinery and Electricity.

The part which machinery and electricity will play in the coming exposition is a more important one than ever assumed by these two great industries in former expositions. In a general way it may be said that but few important changes or improvements will be shown in the service of the Paris Exposition over the Columbian Exposition of 1893. The French classification, however, is a distinct advance over that of any previous exposition, inasmuch as it provides for the installation of the finished product together with the machinery and processes used in connection therewith. Under this classification collective exhibits will be most successful in presenting to the visitors a clear understanding of the state of the art in that particular industry.

General Service Plant.

The great service power plant of the exposition will occupy a favorable position in the main group of buildings. It will be installed immediately adjoining the space allotted for the exhibits of electrical and other machinery, and any benefit which might naturally accrue to the builder of machinery installed in the service plant will be accentuated by reason of its being located in close proximity to the exhibits not offered for regular service. The capacity of the boiler plants for the service of the exposition will be approximately 20,000 horse power. The two plants will feed into one general system of mains and distributors, and either, or both, may be utilized at the same time, as occasion requires.

The engines and generators for this power plant will be placed in close proximity to the underground subways carrying the steam and other mains. Each power unit must be of the direct-connected type, the generator armature being mounted directly upon the extended shaft of the engine. The designation of these units, according to the exposition nomenclature, will be "electrogene groups." It is proposed by the administration to divide the total power comprised in the several electrogene groups required equally among the French and foreign builders. From present indications, manufacturers will offer electrogene groups largely in excess of the requirements of the exposition. No actual contracts have as yet been made for them for either the French or foreign sections, except a nominal arrangement entered into some time ago with three German manufacturers, who desire to furnish equipment approximating 5,000 horse power.

Transportation Division.

The exhibit of automobiles or horseless carriages, trolley cars, railway trains, etc., will be made in the special pavilions provided at the annex in the park at Vincennes. A special track will be provided there for trials and tests, and for the daily speeding of automobiles, bicycles, tricycles, etc. The electric vehicle is at present very popular in Paris, and will no doubt come in for its full share of interest.

Historical Exhibits.

In addition to the contemporary exposition, the official classification provides for the installation of a retrospective exhibit, which shall present an historical view of the progress in all branches of industry during this century. The department of electricity has been specially favored in this regard by the construction of a special salon d'honneur within the Palace of Electricity, where the retrospective exhibit covering the great field of electricity may be properly undertaken, and where the personal exhibits of the great inventors of the century and the collective exhibits of associations or individuals may, in their several ways, illustrate the evolution and advance of science.

Organization and Classification.

For the information of those interested in the organization of the technical service under the di-

rector-general of exploitation it is desirable to state that the mechanical installations will be under the immediate direction of Monsieur Ch. Bourdon, professor of the Central School of Arts and Manufactures. The work of this department falls under two distinct categories. The first relates to the execution of the necessary installations for motive power, and may be subdivided as follows:

(a) Production of steam.
First—Installation of boilers.
Second—Construction of flues and chimneys.
(b) Distribution of water and steam.
First—Construction of subways.
Second—Installation of steam mains, etc.
(c) Production of power.
Installation of electrogene groups.

The distribution of motive power is practically assigned to the service of electric installations.

The work under the second category is of an administrative order, and especially concerns the general conditions of exploitation of the boilers and electrogene groups and such other apparatus as is required for furnishing the steam for power service.

The total mechanical power furnished will be in the neighborhood of 20,000 horse power, of which 15,000 horse power will be for electric lighting and 5,000 horse power for motor service. These figures, while not absolutely correct, are those used by the administration as the basis of the installation.

In the two power plants the boilers will be placed in two lines of batteries, with the boilers back to back. Ample space for general circulation of the public has been provided.

The location of the electrogene groups operating as generating units for the power plant will be within the regular exhibit space devoted to the department of machinery and electricity, as shown in Fig. 2, above. Electricity will furnish the motive power for the operation of an intramural elevated railway, which will encircle the Champs de Mars, pass in front of the main palace on the Esplanade des Invalides, and along the Quay d'Orsay from the bridge of Alexander III. to the Eiffel tower.

There will be no regular compressed-air service established by the exposition administration, but arrangements will be made with the City Public Service company, whereby compressed-air mains will be brought into the exposition buildings and air service offered to the exhibitors at the regular city rates, less 10 per cent.

Service Power Plant.

The controlling minds of this great undertaking have not lost sight of the artistic side of questions surrounding the service power plant, and in the construction of the chimneys for the two boiler plants ample provision has been made for the æsthetic treatment of the exterior of the towering stacks which will conduct the gases from the furnaces.

Two monumental chimneys have been designed, each to be ornamented in a manner indicated in Fig. 4, shown herewith. The height of each will be 230 feet above the level of the Champs de Mars, the inside diameter at the base 28 feet, and at the summit 23 feet. These chimneys are to be illuminated at night, and will thus trace a striking outline upon the dark background of the sky. A general plan and section of the boiler plants are shown in Figs. 2 and 3 on this page, while a longi-

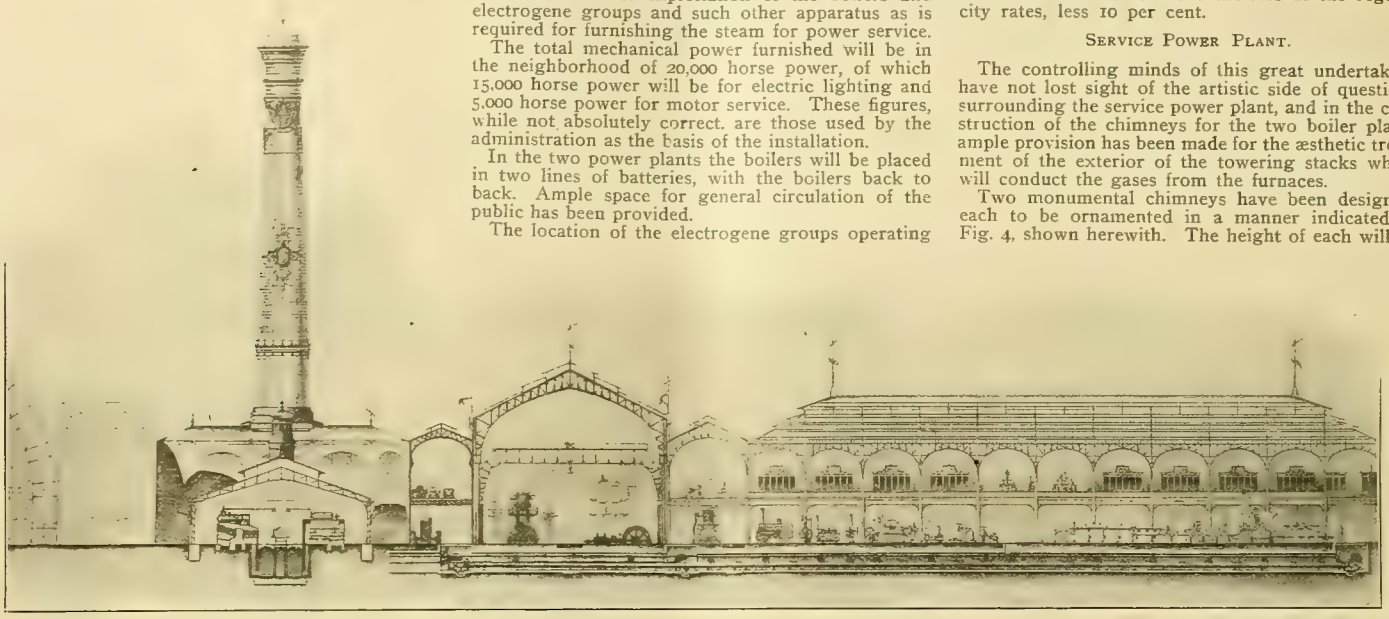

Fig. 4. Sectional View (Longitudinal) of Power Plant showing Ornamental Stack.

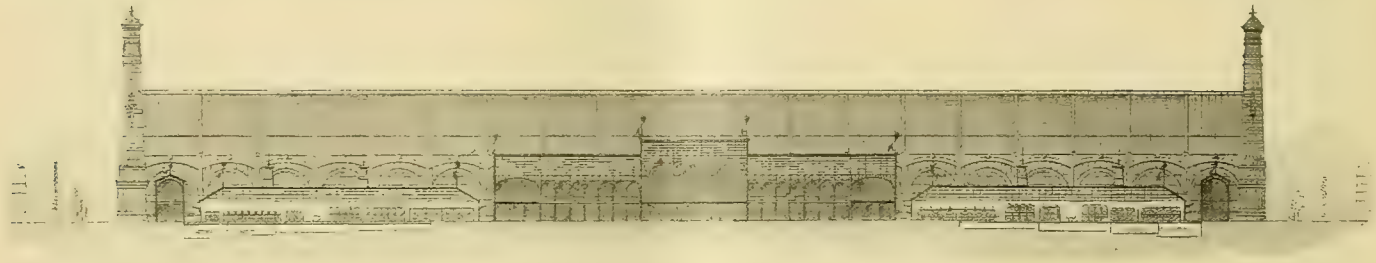

Fig. 3. Cross Section of Power Plant.

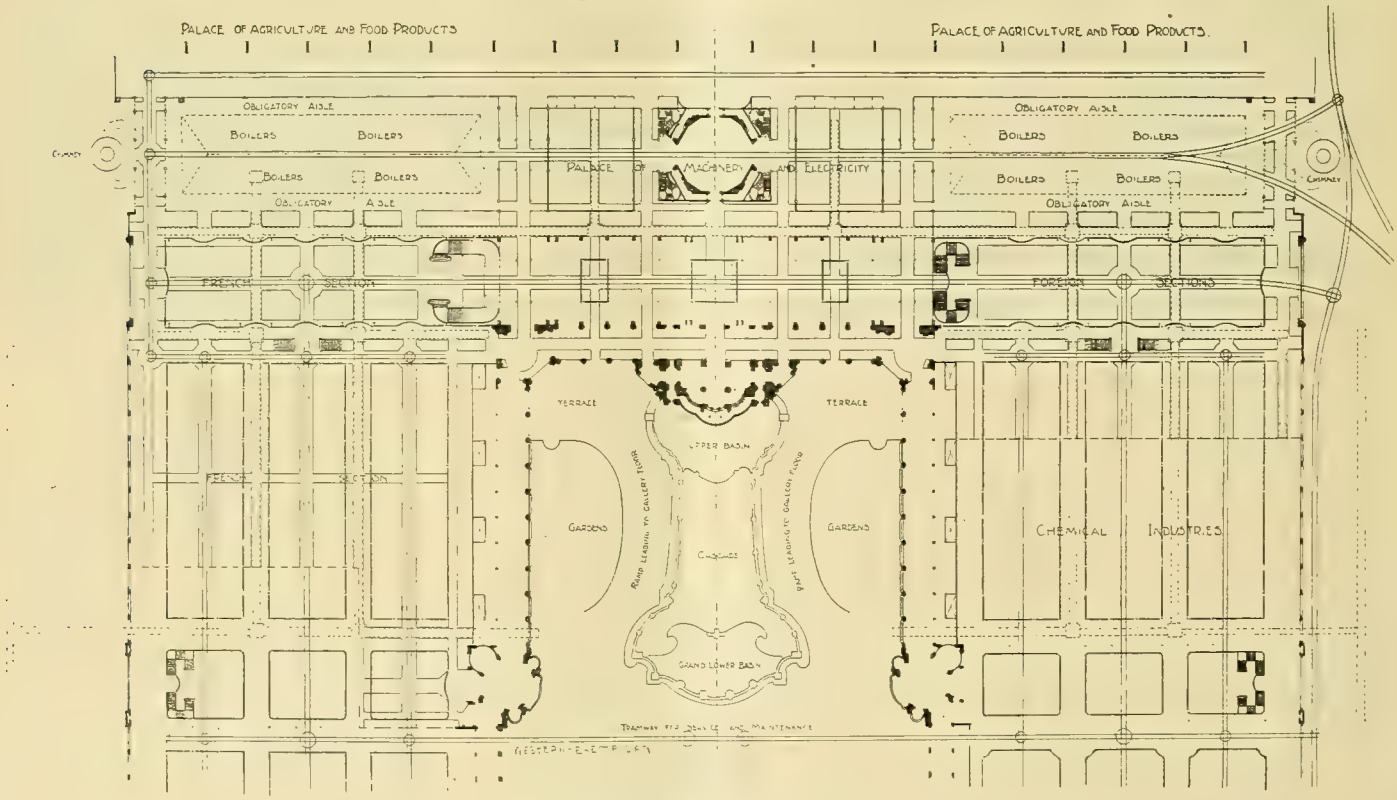

Fig. 2. Plan of Palace of Electricity and Service Plant.

THE PARIS EXPOSITION OF 1900.

tudinal section parallel with the axis of the Champs de Mars, showing the boiler plant, Gallery of Machines and Palace of Machinery, is shown in Fig. 4, page 324.

In appropriating funds for the power plant the administration has, upon the advice of the technical committee, provided a minimum sum, which may be said to be only about one-third of the allowance made for the use of power units at the Columbian Exposition of 1893. The great commercial rivalry between the principal nations of Europe has been a factor in determining the course of the administration. Many large concerns would have granted the use of engines and dynamos during the period of the exposition without charge, providing advantageous arrangement of space, etc., could have been assured them. It was after mature deliberation, however, that the authorities settled upon a very nominal compensation, which should apply alike to French and foreign manufacturers.

The details and conditions surrounding the tenders of electrogene groups are recited in the official specifications appended:

General Conditions of Installation and Exploitation of Engine-Dynamo Groups.

Art. I. General Requirements.—The electrical energy required for the Paris exposition of 1900 will be produced by engine-dynamo groups, the steam engine of which will operate condensing; the generator armature to be mounted direct on the engine shaft, thus excluding all cables and belts.

The administration will contract either with one builder only for the combined group, or simply with the builder of the steam engine and with the builder of the generator.

Art. II. Technical Requirements.—The steam in the main pipes will have a mean effective pressure of 142 pounds per squre inch; this pressure may vary 10 per cent. either above or below normal.

The electric current generated will be delivered to a switchboard furnished by the contractor. The following voltages will be permitted:

Continuous current.....125, 250 or 500 volts.
Alternating current.....2,200 volts with a frequency of 50.
Three-phase current.....2,200 volts with a frequency of 50.

Art III. Special Requirements.—As the apparatus installed under these articles will also be considered as exhibits, the conditions of the general regulations of the exposition will apply to these groups.

The apparatus will be submitted to the examination of the international jury and admitted to compete for awards. In consequence of this particular stipulation the furnishing of these apparatus will be made under the same conditions as govern

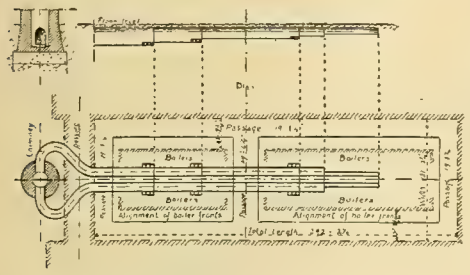

FIG. 5. THE PARIS EXPOSITION OF 1900.—GENERAL ARRANGEMENT OF ONE SECTION OF BOILER PLANT.

other exhibited apparatus, that is, nothing will be granted to the exhibitor as allowance for expenses except for the installation and exploitation of the apparatus, which remuneration is specified in Art. IX., below.

Art. IV. Conditions of Installation.—The installation of the apparatus will be made according to plans established by the builder and accepted by the director-general of exploitation on a favorable report of the technical committee and annexed to each copy of the contract. The builders will conform to the regulations enjoined by the administration concerning public safety.

Foundations.—The administration will furnish the necessary floor space to the exhibitors, who will provide all foundations and accessory works at their own expense.

The materials employed for the construction of the foundations will remain, after the exposition is over, the property of the builders, who may remove or abandon them as they may elect.

Piping.—The steam engine builder will establish at his expense special piping to his engine from the main steam pipe provided by the administration. A throttle valve will be supplied by the engine builder at the junction of his piping with the exposition mains. The engine builder will also furnish and erect the feed-water pipes and evacuation pipes for the hot water of condensation as well as all necessary valves, traps, etc., to be placed at the junction with the main piping. The pipes conveying live steam and cold water as well as for the outlet of the hot water from condensation will be placed in underground conduits connecting the engines to the underground galleries in which are installed the main distributing pipes. These main galleries and pipes will be established by the administration, and the private piping will be installed by the exhibitors at their expense. Special regulations will fix the details to be observed concerning valves and joints.

Switchboards.—Each generator will be provided with a switchboard having the necessary means of interruption and protection such as are usually employed, also current-measuring apparatus to be approved by the administration. The administration also reserves the right to require the use of current-registering apparatus.

For the alternating-current generators the contractors will be obliged to furnish and install the necessary transformers for the distributing stations, so that the current of these alternators may be rendered available.

Art. V. Duration of Service.—The duration of service is that of the exposition itself, that is, from April 15 to November 15, 1900, 205 days. The administration reserves the right to vary this period not exceeding 30 days, in which case no modification concerning the remuneration allowed will be made.

Art. VI. Daily Service.—The duration of each day's service and the duration of working hours will be determined by the director-general of the exposition according to service requirements. The builders agree to furnish at any time the maximum amount of power they have undertaken to supply.

The director-general of the exposition will establish between the several builders an equalization of work so as to permit proper working and resting periods for facilitating the visiting, cleaning and repairing of apparatus without causing any inconvenience to, or disruption of, the regular service.

Art. VII. Measurement of Energy.—The administration, with the assistance of the contractor's employes and at his expense, will make such experiments and tests as are necessary to ascertain if the engines and generators are capable of furnishing the power stipulated in the private contracts. An official report will be made concerning these tests. At any time during the exposition period these tests may be renewed to verify the previous reports.

Art. VIII. Financial Conditions.—The live steam required by the engines and water for condensing will be furnished by the administration free of charge. The builders will receive: (1) A fixed sum to remunerate them for a portion of the prime installation expense; (2) a sum proportionate to the number of hours of work at the normal rating of the group as accepted by the administration. These sums will be fixed according to the power of the units as determined in the private contracts and in accordance with the following tables (the amount to be contributed by the administration toward the first cost of installation is presented in Tables No. 1 and No. 2.):

Table No. 1.

Total allowance:	Engine.	Dynamo.	Together.
Total maximum contribution	$26,330	$19,300	$65,630
Amount allotted to the French section (Plant La Bourdonnais)	23,165	9,650	32,815
Amount allotted to foreign section (Plant Suffren)	23,165	9,650	32,815

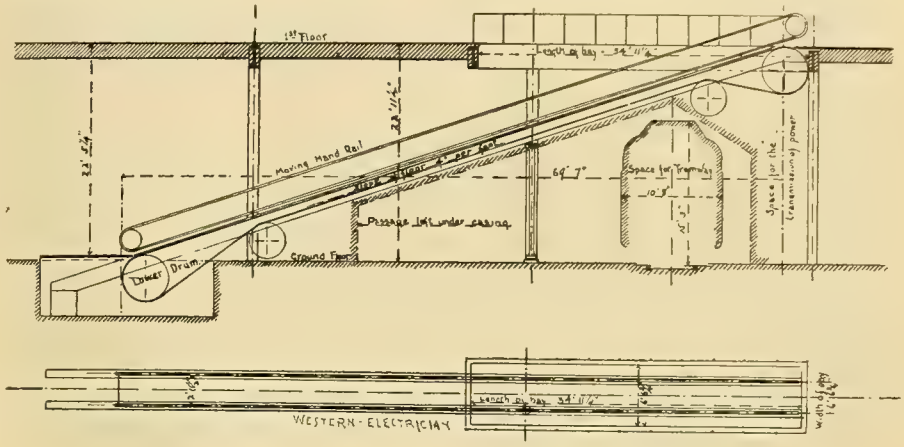

FIG. 6. THE PARIS EXPOSITION OF 1900.—DIAGRAM SHOWING INCLINED ELECTRIC ELEVATOR (ESCALADER).

Table No. 2.

Allowance per indicated horse power:	Amount allowed per horse power. Engine.	Dynamo.	Together.
For the first 1,000 H. P.	$1.92	$ .78	$2.70
For 1,000 to 1,500 H. P.	1.37	.24	1.61
For all above 1,500 H. P.	1.00	.18	1.18

In the event of the maximum horse power accepted by the administration from foreign builders being such as to make the total remuneration based on Table No. 2 greater than the total sum for this service as established in Table No. 1, a proportionate reduction will be made on the horse power allowance for each builder which shall be commensurate with the increase in total horse power over the limit established by the appropriation.

The capacity of the groups admitted for service will be so proportioned that this reduction will not exceed 50 per cent.

Table No. 3.

(Sums representing the administration's contribution toward the expense of exploiting and operating the electric groups).

Allowance per I. H. P. per Hour.	Per Horse Power.— Engine.	Dynamo.	Together.
For the first 1,000 H. P.	Cents 0.162	0.138	0.300
From 1,000 to 1,500 H. P.	Cents 0.067	0.057	0.124
Above 1,500 H. P.	Cents 0.056	0.046	0.102

The administration guarantees to the builders a minimum duration of work fixed at 500 hours.

Art. IX. Terms of Payment.—The remuneration above stipulated will be paid to contractors as follows: On July 10, 1900, payment of the number of working hours furnished from the beginning of the exposition up to and including June 15th; on September 10th for the number of working hours furnished from June 15th to August 15th: one month after the close of the exposition the balance covering the number of working hours furnished after August 15th. That portion of the remuneration allowed toward first cost of installation will be paid in thirds on the same dates.

Art. X. Date of Delivery.—The contractors agree to begin the foundations for the engines and dynamos not later than October 15, 1899. If at that time they have not taken possession of the space granted to them and are unable to show satisfactory progress in the construction of the apparatus and in arrangements for prompt delivery, thus assuring the administration of the fulfillment of their obligations, the right to cancel without indemnity the contract between the administration and the contractor is reserved to the exposition officials.

The contractors must complete the installation of their groups on or before March 15, 1900; on this date will begin the trials mentioned in Art. VII.

Art. XI. Penalties Exacted for Delays.—In event of delay beyond the time fixed in Art. X. for the installation of the plant the administration will exact the following penalties and will deduct them from any sums which may ultimately be due to contractors from the exposition. (1) A penalty equal to the allowance corresponding, for the apparatus referred to, to the normal service of the group during a working day of seven hours. (2) a penalty on the allowance made for installation expenses, which will be calculated by multiplying the amount of this remuneration by a coefficient of reduction equal to the ratio of the number of days delayed to the total duration of the exposition.

Art. XII. Cancellation of Contract for Excessive Delays. If the apparatus is not in condition to furnish a regular service beginning with May 15, 1900, the administration reserves to itself the right to cancel the contract made with the builder without indemnity being due to either party, and without remuneration for installation expenses to be paid by the administration.

Art. XIII. Penalty in Event of Interruption of Service.—In case of interruption to the regular service, aside from the resting hours fixed by the director-general of exploitation, the contractor will have imposed by the administration for each day of said interruption a penalty equal to the allowance corresponding, for the apparatus referred to, to the normal service of a day of seven working hours.

If this interruption exceeds a period of 10 days, a second penalty will be exacted and deducted from the remuneration provided by the administration toward the installation expenses, which penalty will be calculated by multiplying the amount of such remuneration by a coefficient equal to the ratio of number of days of delay to the total duration of exposition.

Art. XIV. Employes.—The director-general of the exposition will retain the right to require the discharge of any agents or employes in the service of contractors for insubordination, incapacity, intemperance or want of probity.

Art. XV. Medical Service.—The builders, being considered as exhibitors, as stipulated in Art. III., will not be classed as contractors for the masonry work required; therefore, the amount of their contracts will not be submitted to the customary deduction of one per cent. for medical service required in Art. XVI. of general conditions.

On the other hand the employes of the builders, in case of injury or accident, will receive only the "first help to the injured," the regulations of Art. III. and IV. of the "Arrêté Ministériel" not applying to them.

Art. XVI. General Regulations.—The contractors agree to conform to all the regulations promulgated by the director-general of the exposition. They will be held responsible for accidents caused by their apparatus or employes.

Disagreements between the administration and contractors must be, previous to any definite action, examined by three competent members of the technical committee. One of these members will be chosen by the commissioner-general of the exposition, the second by the contractor, and the third will be chosen by the two first-named members.

The contractors agree to withhold any procedure or action at law until after having submitted the disagreement to the council of arbitration as above provided for.

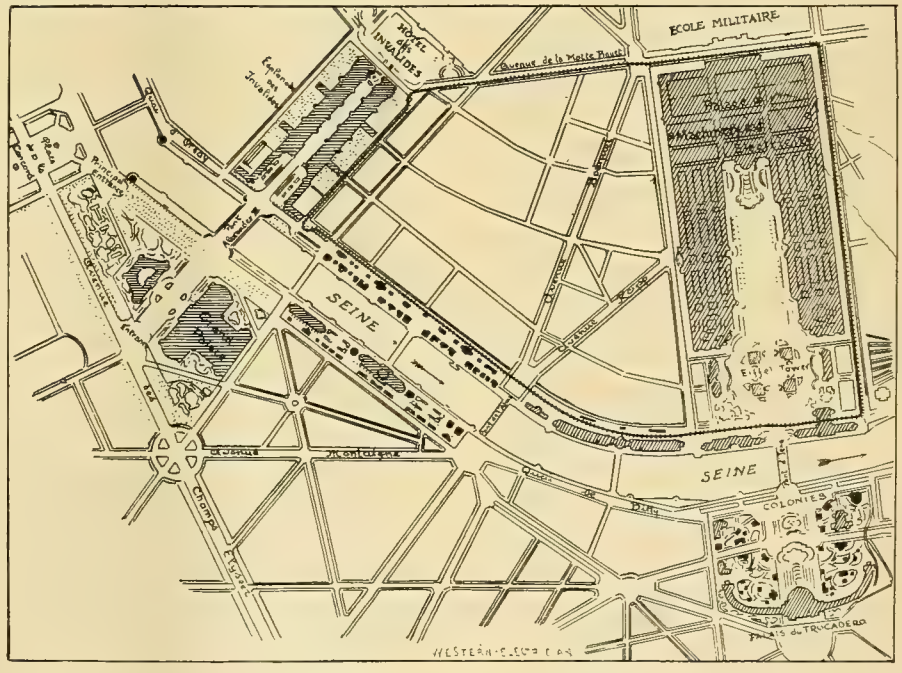

FIG. 7. THE PARIS EXPOSITION OF 1900.—GENERAL PLAN.

In the main the general conditions of installation and exploitation of steam boilers are similar to those governing the engine-dynamo plant, but there are

some special features which are presented in the following abstract:

SPECIAL CONDITIONS OF BOILER INSTALLATION.

ART. I. [illegible] REQUIREMENTS.—The steam required for the production of motive power for the Universal Exposition of 1900

FIG. 8. THE PARIS EXPOSITION OF 1900.—MAIN ENTRANCE.

will be produced by two distinct plants, one, called "Usine La Bourdonnais," being reserved for French builders, will be placed in the court of 117 by 40 meters situated between the Palace of Electricity, Palace of Agriculture, Palace of Machinery and the passage along the Avenue de la Bourdonnais the second, reserved for foreign builders, will be placed in a court situated next to the Avenue Suffren and called "Usine Suffren."

These boiler plants will be formed by groups of boilers, each group being able to produce under normal conditions a minimum of 22,000 pounds and a maximum of 44,000 pounds of steam per hour.

The administration of the exposition will not contract for more than one group with the same builder.

ART. II. SPECIAL REQUIREMENTS.—(Same as Art. III., engine-dynamo groups.)

ART. III. CONDITIONS OF INSTALLATIONS.—(Same as Art. IV., engine-dynamo groups, with the following additions:)

Chimney Flues.—The main flues for smoke from both boiler plants will be established at the expense of the administration. Junction pieces will be prepared to receive the ends of the flues from the different groups of boilers. The private flues connecting the boilers to the main flues will be made by the contractors at their expense after the approval of the plans by the director-general of exploitation.

Smoke Stacks.—A large smoke stack will be established by the administration for each boiler house.

Steam Pipes.—The administration will furnish the main piping connecting the boiler houses with the engine rooms and the different parts of the exposition where steam is required, but each builder must furnish at his expense the connection from his boilers to said main pipes.

Feed Water.—The administration will furnish main feed-water pipes through which will be conducted the water required for the boilers, but contractors must connect their feed tanks or pumps to these mains.

Sewerage.—General sewer pipes will be established by the administration. The contractors will be required to make at their expense the connections to the sewers from the boilers, blow-offs, drains, etc.

Condensers.—To avoid the escape into the atmosphere of the steam used in the different auxiliary apparatus, the administration will erect independent condensers into which this steam will be evacuated.

Main overflow pipes for these condensers will also be established by the administration, but the contractors must connect their apparatus thereto at their own expense. They must also establish a security escape into the open air.

ART. IV. TECHNICAL CONDITIONS.—The steam apparatus must comply with the conditions of French laws and regulations concerning public security unless exceptions have been granted by the minister of public works, that is, apparatus built according to legal requirements and subjected to official security tests established by law in the originating country may be accepted upon the proper recognition of such requirements and tests being in consonance with French law. The administration, on the advice of the technical committee, reserves the right to require such other safeguards or safety appliances as it may deem necessary for apparatus working near the public aisles and passageways.

The boilers and their accessories must be established and the conditions of regulation carefully observed for a normal working pressure of 156 pounds per square inch.

Plans of Installation.—General and detailed drawings must also be submitted to the technical committee, this committee prescribing the conditions to which the builders must conform in the installation they undertake.

The committee may particularly require satisfactory arrangement concerning the installation of the boilers from the chimney flues, water pipes, steam pipes etc. All feed pipes, etc., must be installed and maintained in perfect condition.

The furnaces shall be constructed so as to avoid the production of opaque smoke, the fuel adopted by the builder being carefully selected with this end and view.

ART. V. MEASURING AND CONTROLLING APPARATUS.—The builders agree to mount on their boilers such indicators, gauges or verification apparatus as the director-general of exploitation may deem necessary, and to have such experiments made as the technical committee or jury of awards may demand.

The builders will furnish, mount and keep in repair at their own expense during all the time of the exposition a suitable water meter of one of the patterns accepted by the administration, to be installed on the pipe supplying the feed water to their boilers, readings of the meter to be taken every day by the inspector of mechanical service, who shall keep the key to such water gauge; two seals will be placed by said inspector on the feed and outlet pipes of the meter.

The builders agree not to blow off the boilers except in the presence of said inspector and will make sure that the evacuation and overflow cocks are closed in due time, so as not to show erroneous results concerning the vaporization.

A special steam outlet will be located between the boiler and the main throttle valve, according to the conditions to be prescribed by the director-general of exploitation, which will permit the measurement of the water carried away by steam.

Arrangements will also be made for the reading of the temperature of the gases escaping from the furnaces and for analyzing them.

ART. VI. DURATION OF SERVICE.—(Same as Art. V., engine-dynamo groups.)

ART. VII. DATE OF DELIVERY.—(Same as Art. X., engine-dynamo groups.)

ART. VIII. DAILY SERVICE. (Same as Art. VI., engine-dynamo groups.)

ART. IX. FINANCIAL CONDITIONS.—The feed water will be furnished free of charge, according to the conditions of Art. III. As explained in that article, the chimney flues as well as the general steam feed, sewerage and overflow pipes will be furnished by the contractors at their expense as well as all dampers, cocks, gutters, and in a general way, all other accessories required.

The administration will furnish the boiler house. The fuel, necessary employes and all other expenses concerning the installation as well as for the exploitation and trials will be at the expense of the builders. The exploitation will therefore entirely be at the expense of the builders, particularly that which concerns fuel, employes, etc., and these expenses will be settled directly by them without any interference by or responsibility resting on the administration, which will in no case assume any expenses incurred inside the grounds of the exposition by the builders engaged to furnish the steam.

Within the grounds no fuel, ashes, etc., will be allowed to be stored, except in sacks.

The remuneration allowed to builders includes: (1) A fixed sum representing the administration's contribution toward the expense of installation of boilers and their accessories. This sum is fixed at $289.50 per 2,200 pounds of productive capacity of steam per hour, as contracted for by the administration and appearing on the private contract of each builder. This productive capacity will be determined by the technical committee and will, in any case, not exceed 122 pounds per square foot of grate surface.

(2) A sum representing the administration's contribution to the expense of exploitation, which sum is fixed at 85 cents per 2,200 pounds of steam effectively produced from the opening to the close of the exposition and during the working hours fixed by the director-general of exploitation.

ART. X. TERMS OF PAYMENT.—(Same as Art. IX., engine-dynamo groups.)

ART. XI. PENALTIES EXACTED FOR DELAYS.—(Same as Art. XI., engine-dynamo groups.)

ART. XII. CANCELLATION OF CONTRACTS FOR EXCESSIVE DELAYS.—(Same as Art. XII., engine-dynamo groups.)

ART. XIII.—PENALTY IN EVENT OF INTERRUPTION TO SERVICE.—(Same as Art. XIII., engine-dynamo groups.)

ART. XIV. ACCOUNTS.—The administration reserves the right to take for the regulation of the accounts any steps necessary, or to make tests and trials so as to be informed as exactly as possible concerning the power produced by the boilers and accessories.

ART. XV. REGULATIONS.—(Covered in Art. XVI., engine-dynamo groups.)

ART. XVI. EMPLOYES.—(Same as Art. XIV; engine-dynamo groups.)

ART. XVII. RESPONSIBILITY.—(Covered in Art. XVI., engine-dynamo groups.)

ART. XVIII. MEDICAL SERVICE.—(Same as Art. XV., engine-dynamo groups.)

ART. XIX. DISAGREEMENT.—(Covered in Art. XVI., engine-dynamo groups.)

INCLINED ELECTRIC ELEVATORS.

A new feature of the exposition service is the "escalader," an inclined elevating way, constructed in the form of an endless carpet or belt, propelled by a drum at one end. No former exposition has made such generous provisions for means of carrying the public to the galleries, and as the typical "escalader" has been so recently brought into public use, nearly everyone in the commercial world will be anxious to see the results obtained with it. The extent to which the elevating stairway may be successfully used can scarcely be estimated at this time. They are said to be safe, easily installed, simple to operate, and their capacity is far in excess of vertical elevators so far as transportation from floor to floor of large crowds is concerned. Such devices have long been sought for large stores, elevated railway stations, etc. Privilege has been granted the commissioner-general for the United States to install a working exhibit of one or more of these "inclines" in or near some United States section.

The terms under which the inclined electric elevators are to be installed are essentially the same as those of other exhibits that find a place in the service plant of the exposition. There are special conditions, of course, and details of construction

FIG. 9. THE PARIS EXPOSITION OF 1900.—BIG WHEEL.

that may prove interesting to those considering this class of apparatus. The competition will be divided into two lots, one composing 13 elevators in the palaces fronting on Avenue Suffren, and the other 14 in the palaces fronting on the Avenue de la Bourdonnais and Constantine.

The following abstracts from the official specifications cover the principal points of interest:

The inclined elevators, their electric motors, means of transmission and other accessories, will be established in conformity with the general regulations to the general design accompanying these articles.

The beams supporting the inclined elevators will be supported on the upper floor by one or two pillars resting on a solid mass of masonry level with the ground floor. They may also be supported at some point of their lines by one or two additional pillars, in line with the pillars of the palace proper.

The bay to be cut through the upper floor will be established by the administration at its expense. The contractors shall provide for a platform of a particular type acceptable to the administration. The bay will be 6 feet 6¼ inches in width and 32 feet 9¾ inches long.

The apparatus will be constructed for one file of passengers, and the proportions will be as follows:

Width of carpet or elevating surface.....23⅝ inches
Distance between railings.....35 7-16 inches
Grade of incline per foot (approximately).....4 inches
Capacity of the elevator in passengers.....20 passengers
(Normally one person per yard.)
Capacity of elevator in passengers.....40 passengers
(At maximum two persons per yard.)
Distance between the surface of ground floor and the surface of the gallery floor.....23 feet

The apparatus will be installed for a minimum speed per second of 19 11-16 inches and a maximum speed per second of 23⅝ inches.

The conveyor, properly speaking, will consist of an endless belt or platform constructed of pliable and yet resisting material, which will roll continuously and uniformly and must possess both softness and necessary rigidity for the service to be performed.

When in operation the rolling surface must so move over the supports or rollers as to cause no perceptible or disagreeable effect beneath the feet of the passengers.

The devices for stretching this moving surface, or scheme for "taking up the slack," must allow for all the elongation which may be produced during the entire period of the exposition, so that it will not be necessary to dismantle any portion of the elevator during such time.

The entire inclined elevator must work absolutely without noise. All mechanical apparatus connected with the elevator which may need oiling or greasing must be so arranged as to avoid all possibility of contact with passengers or their garments.

The electric motor and the apparatus for driving the elevator must be placed as near as possible to the elevator.

All parts must be accessible, either from the ground floor or the platform on the gallery floor, for the maintenance in operation.

Proper arrangements must be made so that, in event of damage or accidents to the motor or mechanism, the rolling surface loaded with passengers can not receive a descending movement.

The side rails will be also formed by endless cables, so constructed that they will present under the hands of the passengers a soft and clean support.

The upper part of this endless cable or moving side rail at the height of the hand will only be seen; the lower part will be inclosed by framework which will have a practically plain and smooth surface offering no possibility of accident to the garments of the passengers. These moving side rails must have precisely the same speed as the elevating surface proper.

The tests of capacity of the elevators will be made under a load of 7,780 pounds, representing the weight of 50 passengers, uniformly spread over the lines of the elevator. This load will be retained as long as deemed necessary by the administration.

As it is impracticable to make the tests of capacity under a load equal to 50 passengers, which should be renewed in a continuous fashion, the device for stretching the endless belt or moving elevator will be arranged in such a manner as to give to it a tension corresponding to that which it would receive under the weight of 50 passengers or the equivalent of 7,780 pounds.

Under this tension the maximum speed must be maintained continuously as may be required by the administration.

The electric current necessary for the electric motors will be supplied by the exposition without expense to the contractor.

The remuneration of the contractor will consist of a fee to be exacted of each passenger using the elevators; this fee shall be ten centimes per passenger.

A percentage of each fee for the right of the concession will be allowed the exposition, and the amount of such percentage is to be indicated in the proposition of the bidders; the liberality of this percentage will largely influence the choice of the successful contractors selected by the exposition.

The contractor will be authorized to collect from the public direct the fee of ten centimes for each passenger.

Electrical Features.

Among the special features of interest to electrical men will be the illumination of the grand entrance, shown in Fig. 8, page 326, and the big wheel, which is represented in Fig. 9, page 326. The latter is larger than the Ferris wheel at Chicago, and differs in many important details of construction, as will be noticed by examining the picture. The height of the structure is brought out clearly in the cut, which affords an opportunity to form a contrast with surrounding buildings. The end of the machinery hall of the last exposition, which is to be used as the Palace of Agriculture in the present exhibition, is shown at the right. A double row of incandescent lights outlines the wheel at night. Colored lamps are used extensively at present.

Not all of the main palaces will be lighted at night. The Palace of Manufactures, Palace of Electricity, Palace of Transportation and Civil Engineering, Palace of Textiles, and perhaps one or two other palaces, will be well illuminated every evening. The great Hall of Fetes, which occupies a central position in the Palace of Agriculture, will be illuminated brilliantly whenever in use for evening gatherings. The Palace of Education and Liberal Arts, Palace of Mines and Metallurgy, Palace of Chemical Industries, and Palace of Agriculture will not be equipped for evening illumination.

It is the Palace of Electricity to which all eyes will naturally turn at night, and, as its main façade reaches across the entire width of the open plaza in the center of the Champs de Mars, splendid opportunity will be afforded for the attractive treatment of the architectural features of the exterior of this palace. A reproduction of the official sketch prepared by the architect and adopted by the administration, showing the front of the Palace of Electricity and the principal features of ornamentation, is presented in Fig. 1. Immediately in front of the Palace of Electricity is the grand Château d'Eau, which, as planned, will assume the character of an immense fountain with a series of cascades, to be effectively illuminated by vari-colored lights, thus making a most brilliant and striking attraction for the evening. A very ingenious scheme has been undertaken in connection with this Château d'Eau. All of the water used in the power plant for condensing purposes is to be discharged through the Château d'Eau and the cascades surrounding it, thus making use of this water in artistic effects, and obviating the necessity of pumping from the river another great volume of water simply for fountain use.

The administration has considered well the necessity for making the gallery space in the various palaces as accessible to the public as possible, and provision has been made not only for numerous vertical elevators of steam, electric or hydraulic type, but for a large number of inclined elevating ways, or "rolling carpets," to carry the passengers easily and speedily from the crowded ground floor to the galleries, where many interesting and instructive exhibits will be installed. The limited ground area at this exposition makes necessary the husbanding of all available gallery space. On the Champs de Mars there will be installed 14 of these elevators, or "escaladers," which will have a capacity each of not less than 3,000 passengers per hour. A fee not exceeding two cents for each passenger will be charged for the use of these "escaladers."

Surface-contact Electric Railways.[1]

By Edward H. Johnson.

Part I.

In considering the problem of electrically operated surface railways, as in considering other problems, one inventor will from motives of expediency

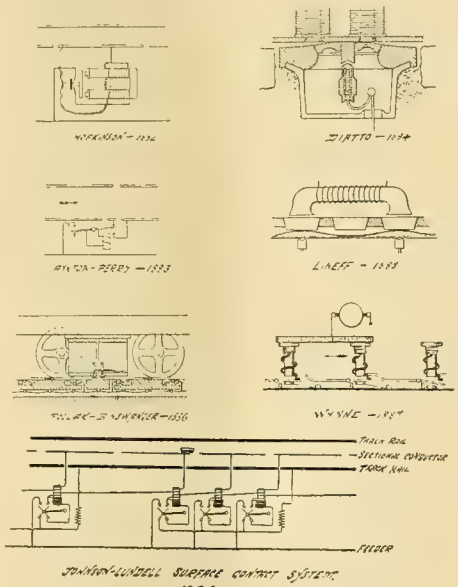

FIG. 1. SURFACE-CONTACT ELECTRIC RAILWAYS.

follow the general trend of the commercial evolution of his art, while another will look beyond and seek that solution which shall possess the element of permanency by virtue of being founded on correct theory.

In no branch of modern electrical development has this divergence of inventive tendency been more marked than in that of electrical distribution for tram-car service. The quick, cheap and effective overhead trolley afforded the "expediency" inventor a fruitful field. It was a rich harvest, but it was a harvest of one season only. That season has passed. The phenomenal success of the electric tram-car has in itself forced a "public opinion" in antagonism to the overhead-supply system, hence the "expediency" inventor is again requisitioned and, following his nose with the instinct of his class, says "Take the trolley off the poles and string it in a cable slot." The fact that electricity and water are mortal foes and that a cable conduit is neither more nor less than an open street sewer has no weight with him, since his client's margin of earnings is sufficiently great to permit not only of enormous expenditure for a construction that will secure drainage, but also for paying the considerable cost of the excessive leakage inherent in the system.

It thus comes to pass that in metropolitan streets, where the traffic is of "bonanza" proportions, the problem of complying with a public demand may be and is met by a brute-force solution—a solution neither in consonance with scientific nor commercial principles.

That such a solution of the problem is no solution at all for at least 99 per cent. of the tramways of American cities can easily be demonstrated by a comparison of their possible net earnings and the interest on the great investment demanded by it.

A further development of art is, therefore, essential, and the brother inventor must now, perforce, be granted a hearing. Of him is required a solution of the problem which shall possess the element of permanency and which shall not demand an investment of prohibitive proportions. Immediately this inventor opens with his plan, it is recognized as an old acquaintance, to whom not much attention has hitherto been paid and who has, in the whirl of expediency, been passed by with a gesture of impatience. Present necessity, however, now secures the recognition heretofore denied, and it is discovered that not only is the plan a true solution, but that it was, as a matter of fact, evolved fundamentally from the brain of the late and lamented Dr. Hopkinson, 16 years ago, and it is safe to say that had it met with a tithe of the encouragement given to its overhead and open-conduit brothers, it would have been more speedily perfected, and neither the overhead nor the underground trolley would to-day exist upon a single important street in either town or city.

An important factor effective in retarding the development of a sound system has been the unwillingness of the larger street-railway syndicates to see any underground system a demonstrated success. Their overhead charter rights generally contain an obligation to substitute such a system on proof of its practicability; hence their determination to damn it in the eyes of the public and municipal authority. Even yet the corporations owning franchises, while suffering their associates to develop the costly open conduit in the great and wealthy metropolis, having no fear of its being forced upon their less prosperous lines in minor cities, assume a position of determined hostility toward the cheaper and superior system, knowing full well that a single demonstration of its practicability in New York would promptly compel its general adoption in Philadelphia, Boston, Chicago and elsewhere.

The Permanent Solution.

The surface-contact system, as its name implies, delivers the current to the moving car by virtue of contact between a bar or "skate" carried by the car and sectional conducting metals fixed in the surface of the roadway. The mere statement of the general conditions suggests as an essential requisite that the current shall be there for the car only, and not for the horse or other street user. This in turn implies the automatic charging of the surface-contact points when needed by the car and their automatic discharge when the car has passed, by means of some force associated with the car itself, and since we are dealing with currents of many horse power, it follows that the individual factors in this automatic operation must be absolutely reliable. In fact, the devices employed for the discharge of the current at least must be infallible. Nothing less will avail, since there can be no divided responsibility for accidents resulting from the use of such a system. A live section is as innocent looking as a dead one. It gives no notice to the street user, and hence he is not charged with the responsibility of avoiding it. Under these circumstances, the law would promptly condemn the system and compel its abandonment upon its first offense.

One deterring force of substantial weight which has operated to keep this system in the background is the common impression that these automatic factors could not be designed so as at all times and under all circumstances to possess this property of infallibility. Mr. Lundell and I have, however, held to the contrary, and after more than three years of almost continuous experimental work and practical demonstration are now able to challenge those who hold otherwise to place their finger upon a weakness in the system, which, if accidentally developed, would result in a dangerous electrification of the street.

The history of the origin and evolution of the surface-contact idea is too varied and voluminous to be recounted in a brief paper, but I have prepared a few illustration (Fig. 1) of the most ambitious efforts that have been made, from Dr. Hopkinson down to our own, and will note briefly their salient features.

Dr. Hopkinson (1882), the originator of the idea of surface contact, had only in mind the prevention of heavy leakage from a commercial point of view, and not at all as a matter of securing safety. Hence, his electrical connections were not designed and could not be considered for a moment as factors of safety. He simply overlooked the point of vital importance.

Ayrton and Perry (1883) simply diversified the electrical connections in many ways, but clearly with only the Hopkinson end in view. Their system was not superior to Hopkinson's and therefore no better adapted to secure safety.

Pollock and Binswanger (1886) were among the first to recognize the importance of safeguarding the street, and they adopted the idea of operating switches in the street by electro-magnetism, developed on a moving car. They have had many followers, among whom may be mentioned Wynne (1887), Lineff (1888) and Diato (1894).

The principle has, however, been found inadequate because unreliable at high speed—a fact readily comprehended by those who understand the laws governing magnetism.

1. Read before the New York Electrical Society.

[Continued on page 333.]

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Magnetic deflection of vacuum charges has been the subject of many experiments and investigations without definite results. Among the more recent workers in this field is Professor Henry, who has just published the result of his observations. He endeavored to find the explanation of the change produced in the magnetic deflection of the discharge between a pair of electrodes in a rarefied gas, when the gas carrying the discharge is changed. The behavior of these discharges closely resembles that of a flexible and elastic conducting string stretched between the electrodes, which would be pulled aside while the magnetic force acted, and returned to the straight line as soon as the magnetic force was removed. In order to avoid complications due to electrification of the sides of the tube, a wide bell jar closed by an ebonite plate was used, the electrodes being wires introduced through the neck of the jar and through the center of the plate. The deflections were measured by photographing the discharges. The magnetic field was made vertical and the deflection horizontal, thus avoiding distortions due to convection, at least on the photographic negative. The magnitude of the deflection increased with the density which the gas had at atmospheric pressure, or with the molecular weight of the gas. As long as the current through the gas was kept constant, a change of pressure had little if any influence, and the potential difference between the electrodes was also considered equally unimportant. It was found that the elements which determined the amount of magnetic deflection were exactly the same as those which determined the deflection by a blast across the electrodes, no matter what the cause.

Many of those who advocate municipal ownership do not realize that such a policy would be detrimental to the general good if followed to its logical conclusion. The mayor of Toledo, for instance, at the national conference for good city government held in Indianapolis last week, expressed the view that the public should not grant special privileges to private corporations, and he deplored the fact that the practice of granting franchises to lighting, street-railway and similar companies had been universally adopted in this country. His language is worthy of presentation here, as it fairly represents the views of a large body of active and well-meaning citizens who have an imperfect grasp of the subject:

The process of capturing franchises from the agents of the people has progressed so rapidly that in some cities there seems to be but little left for the public to control. In many places the local government is so bound and helpless and so entirely dominated by the public-service corporations which it has created and nourished that many of the voters now regard it as powerless to promote their interests and unworthy of their respect or support. The lack of wisdom and foresight which has been shown by most of our cities in connection with their franchises may be fairly likened to that of a tribe of Indians selling for a few beads the land which would have yielded them an ample and permanent support.

It is a matter for congratulation rather than regret or reproach that private enterprise has so completely occupied the field as to leave little or nothing to be done by the community through municipal government. It should be remembered that vast sums have been expended by corporations in the development of public enterprises and that the individuals who have pushed forward these improvements and risked their fortunes in them are fairly entitled to consideration and remuneration. It is unfortunate that the tendency toward clean and efficient municipal government has encouraged and given prominence to irresponsible agitators who fail to discriminate between boodlers and honestly conducted corporations. A moment's reflection will convince any business man that the development and improvement in city life and promotion of comfort and convenience of the public which have accompanied the growth of American cities could not have been accomplished had dependence been placed upon the municipalities to do the work. It would have proven a great hardship for cities to have furnished the funds for these enterprises, and, assuming that the administration of such works would be honestly and capably conducted (which it must be admitted is not entirely justified by experience), it is not at all probable that such progress would have been made as that accomplished through private enterprise.

The tendency toward municipal ownership has, it is true, been encouraged in many instances by abuses and mismanagement of public service entrusted to private enterprise, but it would be unjust and unfair to condemn all because of the failure of a few. Again, assuming that the franchises are to be awarded to corporations and that compensation for these privileges is to be exacted, distinction must be made between grants of different kinds, governed by the amount of capital required, the risk involved, the character of the service to be given and the nature of the franchise, whether it is to be for an exclusive privilege or will admit of competition. Public franchises have certainly proved valuable in many instances, although there have probably been as many disappointments and failures, too. It seems only fair that operating companies should pay for franchises, but they should not be compelled to do so while their properties are unproductive. In considering the subject of renewing franchises municipalities can afford to deal generously with corporations that evince a disposition to act fairly toward the public. Much of the trouble between cities and companies heretofore seems to have been due to the fact that each regarded the other with suspicion. A better understanding would greatly simplify matters and enable the people and the companies to reach a satisfactory agreement. The issue should not be obscured by the introduction of irrelevant subjects into the discussion. Each case requires special attention because of particular considerations and each is entitled to careful thought and impartial judgment. Moreover, it is much better to leave such matters to practical business men rather than to theorists and reformers, no matter how eminent the latter may be or how disinterested their motives.

President McKinley's annual message to Congress recommends an increase in the original appropriation for the American representation at the Paris Exposition of 1900. The importance of this great exhibition, especially at this time, when the manufacturing interests of the country are seeking larger markets, is recognized, and the value of the work of the official representatives of the government in securing concessions and favorable consideration for special exhibits is acknowledged. The president pays a deserved compliment to Mr. Peck, the commissioner-general for the United States, and his assistants, who secured an increase of space from 157,403 to 202,000 square feet for American exhibitors and other equally valuable concessions. Mr. Peck has urged a liberal policy on the part of the government in recognition of the courtesy of the exposition management, and the president announced in his message that he would transmit the report of the commissioner-general to Congress. "In my judgment," says the president, "its recommendations will call for your early consideration, especially as regards an increase of the appropriation to at least $1,000,000 in all, so that, not only may the assigned space be fully taken up by the best possible exhibitor in every class, but the preparation and installation be on so perfect a scale as to rank among the first in that unparalleled competition of artistic and inventive production, and thus counterbalance the disadvantage with which we start as compared with other countries, whose appropriations are on a more generous scale and whose preparations are in a state of much greater forwardness than our own."

The work of the commissioner-general and the preparations of the French government have received comparatively little attention in this country, not from lack of interest but owing to the fact that up to the present time reliable information has not been obtainable. Now, however, that the preliminaries have been arranged and the American department has been organized, interest in the preparations is already manifested. The department of machinery and electricity, which is one of the most important branches, is already organized and is pushing its work vigorously. The Western Electrician is enabled to present this week an official statement of the plans of the department and the scope of the work to be undertaken, as well as a general outline of the plans of the exposition. This is the first publication of the terms upon which concessions are to be made for electrical and mechanical exhibits, including the machinery for the service-power plant. It will be noticed that the terms of the exposition management are very exacting and that the compensation for manufacturers of apparatus to form part of the service-power plant is merely nominal. In spite of this fact it is authoritatively announced that the administration's difficulty is not in getting exhibits, but in making selections that will show the greatest advancement in the art.

American manufacturers of elevator equipments will be interested in the announcement that Mr. Drake induced the exposition authorities to make a special concession enabling Americans to furnish two "escaladers" or inclined electric elevators. It was the original intention to permit French builders only to enjoy this concession, and no foreign exhibitors excepting Americans have been granted concessions of this kind. There are many other interesting points mentioned in Mr. Drake's instructive paper, which forms the leading feature of this issue, and it will no doubt receive the attention that the importance of the subject demands.

Patents and Trademarks.

[Special correspondence of the Western Electrician.]

Washington, D. C., December 5.—The commission to revise and amend the patent and trademark laws of the United States, so far as they relate to international matters, has concluded its public hearings and is now at work formulating its report to be submitted to Congress. This report will review the work of the commission at its several sessions held in Chicago, New York and Washington, and will contain recommendations looking to a radical change in the present patent system of the United States.

Arguments made before the commission show that the sentiment in favor of abolishing caveats is strong, but it is not thought that the commission will recommend such a change.

One of the most interesting questions to be discussed in the report is the proposed reduction of fees demanded for the granting of a patent. As is well known, the present fees amount to $35, made up of a first government fee of $15 and a final government fee of $20. It has been suggested that the first and final fees could be placed at $10 each, and it is estimated that the income of the Patent Office would still be sufficient to pay all its expenses. Such a reduction, it is contended, would stimulate business and result in a large increase in the number of applications filed. The officials of the Patent Office, however, do not favor any proposition looking to a reduction in the present fees. They contend that the government fees now charged in the United States are less than those of any other country, but the inventors meet this argument with the statement that as this is the progressive and leading patent nation of the world, an expansion of the present encouragement of inventive genius should be given rather than to place a restriction upon inventors by keeping the fees unnecessarily high.

Few matters affecting foreign trade are recognized as being of such importance as the question of trademarks, and a portion of the commission's report will be devoted to a discussion of the subject of the international registration of trademarks. Consular reports frequently call attention to the practice of foreign merchants in obliterating the American trademarks and substituting other marks. Special emphasis will be laid upon the fact that international registration would be of material value to those of our manufacturers who desire to develop their foreign trade.

Another important question which will be touched upon in the report is one involving the reduction of the fees required upon the filing of an application for registration of a trademark in the United States. The present fee is $25, payable at the time the application is filed, and in case the registration sought is refused, because of conflict with prior existing registered marks, the applicant loses this fee. For the reason that the labor connected with the examination and registration of trademarks is slight, it is contended that the fee should be reduced materially, and it is believed that the commission will recommend a fee of somewhere between $5 and $15.

Information has been received here to the effect that on January 1st there will be enforced in Austria a new patent law, the main provisions of which will be of vast commercial importance to inventors. The law, as it now stands, compels a patentee to work his invention in Austria within one year from the date of the grant of the Austrian patent, and in many cases it has been impossible to comply with this requirement; consequently in that country the fruits of many valuable inventions have been lost. According to the new law, a patentee will be allowed three years from the date of his patent in which to get his first machine to work, or to otherwise put his invention into practical use in that country.

A. F. T.

Closer Regulation of International Telegraphs Proposed.

In his annual message to Congress President McKinley advocated greater uniformity in the regulation of international telegraphic service. He said:

"I have found occasion to approach the Argentine government with a view to removing differences of rate charges imposed upon the cables of an American corporation in the transmission between Buenos Ayres and the cities of Uruguay and Brazil of through messages passing from and to the United States. Although the matter is complicated by exclusive concessions by Uruguay and Brazil to foreign companies, there is strong hope that a good understanding will be reached and that the important channels of commercial communication between the United States and the Atlantic cities of South America may be freed from an almost prohibitory discrimination.

"In this relation I may be permitted to express my sense of the fitness of an international agreement whereby the interchange of messages over connecting cables may be regulated on a fair basis of uniformity. The world has seen the postal system develop from a congeries of independent and exclusive service into a well-ordered union, of which all countries found the manifold benefits.

"It would be strange were the nations not in time brought to realize that modern civilization, which owes so much of its progress to the annihilation of space by electric force, demands that this all-important means of communication, a heritage to all peoples, be administered and regulated in their common behoof. A step in this direction was taken when the international convention of 1884 for the protection of submarine cables was signed, and the day is, I trust, not far distant when this medium for the transmission of thought from land to land may be brought within the domain of international concert as completely as is the material carriage of commerce and correspondence upon the face of the waters that divide them."

Chicago Street Railway Franchises.

The agitation in Chicago over the street-railway problem has finally resulted in the presentation of 50-year franchise-extension ordinances in the City Council, under the provisions of the Allen law.

On Monday evening the City Council received a communication signed by Charles T. Yerkes, president North Chicago Street Railroad company and West Chicago Street Railroad company; M. K. Bowen, president Chicago City Railway company; Charles L. Bonney, vice-president Chicago General Railway company and president West and South Town Street Railway companies; J. D. R. Baldwin, Chicago General Electric Railway company, and D. H. Louderback, president Chicago Electric Transit company, asking for extensions of franchises now enjoyed by these corporations. The letter contained the following paragraph: "During the last 10 years enormous strides have been made toward perfecting intramural transit. Millions of dollars have been expended, all with the confidence that the city would meet the railroad companies in the same spirit as the latter have carried on their work. You are no doubt aware of the fact that the different ordinances formerly granted have from four to 19 years to run, and therefore it would seem that there is no great necessity for the extensions being made at the present time, but we consider that if this is done now the question of the regulation of street railroads and the building and extending of the same will be placed on a more firm foundation and will result more to the satisfaction of the city, as well as to street railroads, than has been the case in the past."

Accompanying this communication was the proposed ordinance, providing that all ordinances controlled by these corporations passed prior to July 1, 1897, and in force on that date, be extended for a period of 50 years; that five-cent fare be continued for the first 20 years; that compensation be paid to the city on the basis of one-half per cent. on total annual gross receipts from passengers per mile of single track, where the receipts exceed $7,500 and not $10,000; one per cent. where receipts are more than $10,000 and not in excess of $12,500; 1½ per cent. from $12,500 to $15,000; two per cent. from $15,000 to $20,000; three per cent. $20,000 or over. No compensation to be paid where receipts per mile of single track do not exceed $7,500 per annum.

Other ordinances were presented on behalf of smaller corporations. One of thees provided for a 50-year extension of the ordinance of the Northern Electric company, which operates in the northwest part of the city. In consideration of this extension, the company offered as compensation one per cent. of the gross earnings of the road for the first five years, two per cent. for the following period of five, three per cent. for the next five, five for the next five, seven per cent. for the next five and nine per cent. for the rest of the term. Another 50-year extension ordinance covering the lines of the Calumet Electric Street Railway company was filed. The franchise contains no compensation clause, excepting the payment of the usual $50 a year as license fee. A third 50-year ordinance was presented, granting the Illinois Traction company permission to operate trolley lines in the southern part of the city. The only compensation mentioned is the usual car-license fee of $50 a year for each car operated.

Alderman Herrmann introduced a 10 per cent., 20-year extension ordinance for all the street-railway companies. It provides for a compensation to the city of 10 per cent. of the gross earnings of the companies from passenger fares, to be paid into the city treasury quarterly. It further provides for a system of transfers, and for a change in the motive power used if the council should so order. The ordinance gives the city the right to purchase the property of the companies at the expiration of the franchises, if it so elects.

All of these measures were referred to a joint committee, representing all sections of the city. An effort was made to have them placed in charge of a select committee, but this was defeated by a vote of 30 to 33, five members being absent. Alderman Powers is represented as saying that 51 votes are pledged to the passage of the ordinances, and in case the mayor vetoes them this number will insure passage over his veto.

Mayor Harrison said: "I am as confident as ever that only 20-year extension ordinances with a compensation of at least 10 per cent. will pass this council. No 50-year ordinances will get through. There are not enough votes. I will fight, however, first for the principle that no 50-year ordinances should be granted. The matter of compensation should come later. The roll-calls to-night do not indicate anything at all. They are not conclusive as to the attitude of the council. There is no possible chance for the gang getting 40 votes to pass the ordinance over my veto. Some of the minority were absent to-night, but they will be present when a decisive vote is taken. The compensation offered the city to-night is absurd. The companies are trifling with the city."

The records of the Harlan special committee of the council, which investigated the street-railway companies of Chicago, show the following mileage and gross earnings for 1897 of the four principal companies of the city, the General Electric not being included, for the reason that it has neither mileage nor gross earnings:

	Mileage.	Gross Earnings.
City Railway	184	$4,189,516
North Chicago	100	2,836,522
West Chicago	202	3,899,918
Chicago General	20	79,821

Assuming these figures to be correct, the compensation which the four roads would pay to the city under the Allen law blanket ordinance would be:

	Per cent.	Amount.
City Railway	3	$125,595
North Chicago	3	85,095
West Chicago	2	77,996
Total annual compensation		$288,682

The Chicago General, under the terms of the ordinance, would escape all compensation payment, because its annual earnings per mile are but $3,991, and compensation only applies to roads earning more than $7,500 per mile.

On this basis, for a 50-year franchise the roads only bind themselves, asuming that earnings all increase to more than $20,000 per mile, to pay in that length of time something like $15,000,000, or an average of $300,000 per year.

Before the council meeting on Monday the street-railway magnates addressed business men and property-owners at a meeting of the Real Estate Exchange. The organization took no action on the proposed measures. Charles T. Yerkes, president of the North and West Chicago companies, stated that the approximate gross annual earnings per mile of the three great trunk lines of the city were:

West Division	$19,000
City Railway	25,000
North Chicago	28,000

Assuming his figures to be correct, and taking the mileage of the three systems, the compensation per annum would be:

	Mileage.	Per cent.	Compensation.
West Chicago	212	2	80,560
City Railway	184	3	138,000
North Chicago	100	3	84,000
Total annual compensation.			$302,560

President Praises the Signal-service Corps.

Cordial recognition of the work of the Signal Service Corps is extended by the president in his annual message. In his history of the war Mr. McKinley says:

"The signal corps was promptly organized and performed service of most difficult and important character. Its operations during the war covered the electrical connection of all coast fortifications, the establishment of telephonic and telegraphic facilities for the camps at Manila, Santiago and in Porto Rico. There were constructed 300 miles of line at 10 great camps, thus facilitating military movements from those points in a manner heretofore unknown in military administration. Field telegraph lines were established and maintained under the enemy's fire at Manila, and later the Manila-Hongkong cable was reopened.

"In Porto Rico cable communications were opened over a discontinued route, and on land the headquarters of the commanding officer was kept in telegraphic or telephonic communication with the division commanders of four different lines of operation.

"There was placed in Cuban waters a completely outfitted cable ship, with war cables and cable gear suitable both for the destruction of communications belonging to the enemy and the establishment of our own.

"Two ocean cables were destroyed under the enemy's batteries at Santiago. The day previous to the landing of Gen. Shafter's corps at Caimanera, within 20 miles of the landing place, cable communications were established and cable stations opened, giving direct communication with the government at Washington. This service was invaluable to the executive in directing the operations of the army and navy."

General Greely, the chief signal officer of the army, intends to prepare a bill for the reorganization of his corps. The plan may be adopted in the general measure for army reorganization, but there is some difference of opinion as to the strength which is necessary to keep up the work of the corps. General Greely's idea is to enlarge the branch by one colonel, one lieutenant-colonel, two majors, five captains, nine first-lieutenants, 40 first-class sergeants, 50 corporals, 250 first-class privates, and 50 second-class privates. It is proposed to fill original vacancies from officers who have served in the war, and no officer, General Greely thinks, should be appointed until he has been approved by a Signal Corps board as to his physical, mental and moral qualifications.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

Frank Bell, who is putting in a telephone exchange at Waupun, Wis., contemplates running a line to Fox Lake and putting in an exchange there.

The Inland Telephone and Telegraph company has purchased a site in Spokane, Wash., for the erection of a three-story block for its exchange and offices. The company will also put its wires in the business portion of Spokane underground in the spring.

The council of Duluth, Minn., has finally passed a telephone ordinance, after deliberating on the matter for a long time.

The extension of a telephone line to Langdon, N. D., has been postponed until spring.

The County Board at Eau Claire, Wis., has adopted a proposition of the Eau Claire Telephone company to furnish service at $24 per annum, and ordered the Bell service discontinued.

Will and Edward Stolte are installing a telephone system at Reedsburg, Wis.

The Northwestern Telephone Exchange company has taken up the line into Mantorville, Minn., built by the Union Electric company.

The St. Peter Telephone company has been incorporated at St. Peter, Minn., by W. S. Proctor, H. P. Proctor, August Proctor and F. A. Chase.

A diphtheria quarantine in Albert Lea, Minn., isolated the Albert Lea College. The local telephone man was called upon to make connection at once, and found there was no telephone wire in the city. He used stovepipe wire, hay-bale wire, clothesline wire and any other wire he could get hold of, and succeeded in furnishing the service.

H. C. Wilmz has succeeded F. J. Menard as manager of the Wisconsin Telephone company's office at Sheboygan, Wis.

A stock company is being formed to put in a telephone exchange at Appleton, Minn.

It is understood that the Cudahy Packing company is building a telephone line between its Sioux City and Omaha offices.

It is now possible for a person in Rossland, B. C., to talk to a person in San Diego, Cal., on the southern end of the state, a distance of 1,700 miles; and there is 21,000 miles of wire available from any point on the circuit. While this is not the longest line in miles, when the difficulties of construction are taken into consideration, it is quite the equal of some others.

The Western Electric Telephone company has decided to go around Mitchell, S. D., with its toll lines rather than pay a revenue of $25 per year for five years, as demanded by the council. Mitchell men had taken $1,400 worth of stock in the company.

The recent storm is said to have carried down 50 poles between Ames, Ia., and Nevada.

The city of Spencer, Ia., will vote December 20th on granting a franchise to the newly organized Citizens Telephone company. There is now one telephone system in operation at Spencer.

The Knoxville Electric company has been granted a franchise in Pleasantville, Ia.

A number of telephone poles of the Boone County Telephone company went down under sleet and wind at Boone, Ia., recently.

A new telephone line is to be built from Audubon, Ia., to Elkhorn and Kimballton.

The Central Union Telephone company is reconstructing the system in Rock Island and Moline, Ill., at a cost of $40,000. There will be new poles, cables and distributing terminals and important changes in the central office.

A new telephone line is being constructed between Tabor, Ia., and Sidney.

The Telephone in Police and Fire Departments of London.

[From the Electrical Engineer, London.]

It will surprise many to learn that the city police have no sort of telephonic communication. Further, it appears that it is not the fault of the telephone company that the numerous police stations in the city and throughout the metropolitan area are without the telephone. The company has done its best to induce the authorities to have the service, but for reasons best known to themselves the said authorities have declined to utilize the privilege. In this particular respect the metropolis seems to be behind many provincial towns. In some provincial towns it is considered necessary for each constable to have a list of the local telephone subscribers, so that he can, if occasion demands, know where to go to in order to get on to the police office. Strangely enough, a comparable deficiency in the organization of the London Fire Brigade exists. According to a representative of the Daily Mail, who had an interview with an official of the National Telephone company, although the telephone is to be found in all fire stations, yet every call to a fire sent over the telephone has, under existing arrangements, to go first to headquarters, and then to be retransmitted to the station in the particular district in which the fire has broken out. "There must be a certain amount of delay under such circumstaces," he observed, "which might be avoided at a comparatively small cost. For instance, say a fire broke out in the neighborhood of Fleet street. The alarm is given on the telephone. The line is cleared at once, but the call has first to go to the Holborn exchange, then to what we call the Hop Exchange, and from thence to headquarters. Then the message to the nearest fire station has to come back via the Hop Exchange, and so it is with other cases when the fire is some distance away. What was suggested to the Fire Brigade committee was that each of the principal fire stations should be so connected that the one nearest the fire would first receive the alarm. Then there could be no delay whatever. But at the time the plan was not adopted—the cost, about £10 a year for each station, being the factor that stood in the way."

Telephony Abroad.

The Bedford, England, Town Council has decided to repeat its application to the postmaster-general for a telephone license.

Colonial telephones was the subject of a recent lecture by the Hon. E. H. Wittenoom, agent-general for Western Australia, and recently minister for posts and telegraphs in that colony, in the course of which he stated that in Western Australia the charge for private customers was £5 per annum for a distance of about 1½ miles. This gives the subscriber the run of the whole town, and an English contemporary remarks, "Considering the difference in the amount of salaries, wages and cost of material as compared with England, this compares with about £3 per annum in London."

Telephonic communication will be established between Antwerp, Brussels and Berlin on the one hand, and Antwerp, Brussels and London (by way of Lille) on the other. A circuit is being made between Paris and Brussels with the object of facilitating telephonic communication between Holland and France by way of Brussels and between the principal Belgian towns and important places south of Paris, such as Lyons, Bordeaux and Marseilles. When these new lines have been completed the establishment of direct telephonic communication between Paris and Berlin, and probably between London and Berlin, by way of Brussels, will be possible.

At a meeting of the London County Council last month a member, referring to the statement of the general manager of the National Telephone company regarding the condition of the service in London and causes for complaint, which was presented in the last issue of the Western Electrician, asked whether it was correct that 900 persons were waiting to join the system of the National Telephone company. It had been said by Mr. Gaine in the statement already alluded to that those persons were unable to get connected up because the council refused to allow the company to place its wires underground. The explanation was made that while it was true that in the development of the telephone system certain consents had been withheld, the company had not been granted permission to place its wires underground, because it had not seen fit to concede terms to London analogous to those ceded in other cities. The highways committee regretted the inconvenience of those who were prepared to pay the present rates of the company. The speaker mentioned further that the committee had made arrangements to meet representatives of the National Telephone company at an early date in order to see whether they could overcome the difficulty.

The National Telephone company is endeavoring to reach an understanding with the Glasgow corporation as to improvements of the local telephone service, and, at the same time, to meet the views expressed by the corporation in the course of the recent inquiry. The company proposes to make the minimum charge £6 per annum for each instrument with a maximum of 500 conversations, any excess to be charged on a fixed scale. In return for these concessions the corporation is asked to withdraw objections to the granting of wayleaves. A special meeting of the parliamentary bills committee of the Glasgow corporation was held recently for the purpose of adjusting the clauses of the bill for power to establish and work a telephone-exchange system in Glasgow. In the course of the discussion the town clerk, Sir J. D. Marwick, questioned the legality of the common good being included in the bill as a guarantee for the scheme, maintaining that only the rates could be used for that purpose. It was pointed out that the common good had been similarly pledged in connection with the tramway scheme, but the clerk was obdurate. The committee was equally emphatic, and the result was that the clerk absolutely refused to have anything to do with the bill or to allow his name to be appended to the notice in the usual way. The committee therefore decided to ask its London agents, Messrs. Beveridge, to attach their names to the notice in terms of the act of Parliament, and to promote the bill.

William Thomson of the Mutual Telephone company of Manchester has made the following statement of the objects of the corporation and its prospects: "At the present moment the question of granting a license to the Mutual Telephone company is under the consideration of the Treasury, and I feel sure that if Manchester will fairly represent the position of the telephone question here a license will be granted. The Mutual Telephone company was formed by reason of and in accordance with the terms of the Treasury minute, which stipulates for competition only by private companies, and as a large amount of time and money has been spent by the few on behalf of the many in the town and district, it is to be hoped that Manchester will not be satisfied with any attempt to repudiate the telephone Treasury minute and to ruthlessly sweep away all that has been done by those who formed the Mutual Telephone company. The recent select parliamentary committee expressed the opinion that competition should be commenced immediately, and the only objection which Mr. Hanbury had to private companies was that they might be bought up by the present licensees. This can be prevented by an undertaking which this company is willing to give. The corporation cannot commence a telephone exchange for a year or two from now, while the Mutual company can commence operations immediately, and, as it is willing to transfer its plant and business at any time to the corporation or to the Postoffice, under conditions which can be arranged before the license is granted, it is difficult to see any reason for withholding the license from it, especially as it would save Manchester people at least £20,000 per annum and give an increased and more efficient telephone service to the city and district."

"Sherlock Holmes" at a Public Telephone.

[From the New Orleans Times-Democrat.]

"The last man who used this 'phone," said a New Orleans Sherlock Holmes, preparing to wrestle with the instrument in an up-town public station, "was a short, little fellow in a deuce of a hurry, smoking a cigarette. He asked for the Illinois Central freight office, was told they were busy, and repeated his request five times, getting madder at each call. Meanwhile his cigarette went out, and after vainly searching for a match"——

"Hold on, there!" exclaimed a friend who had accompanied him to the booth. "What kind of a fairy story are you giving me, anyhow?"

"No fairy story at all," replied the amateur sleuth blandly. "I was merely stating a few facts."

"But how the dickens did you ascertain them?"

"Plain as A B C, my boy. To begin with the adjustable mouthpiece of the instrument is pulled down, as you see, to its fullest extent, indicating clearly that the last user was very much undersized. Isn't that evident?"

"Ye-e-e-es, I guess so; but how about the rest?"

"Well, look at that ledge and you will observe five charred spots and an equal number of small piles of tobacco ash. What do you infer? Why, obviously, that the gentleman was smoking and laid down his cigarette each time he called. The piles of ash are still undisturbed, showing they were recently deposited, and they are small, proving plainly that the intervals of calling were brief. My logical conclusion was that the 'phone he wanted happened to be busy, and I looked instinctively for a memorandum of its number, which most men make under such circumstances. I found it, as I anticipated, on top of the box, scrawled in pencil, and recognized the number of the freight office. Such memoranda are almost always rubbed out by the sleeve of the next customers, and as this one is still fresh and bright, it is fair to presume it was made by the last man in the booth—otherwise, the short chap with the cigarette. Moreover, a freight office 'phone is usually busy at this hour, so the clews interlock and sustain one another. Not so, my dear boy?"

"But the matches?"

"Oh! I deduce the match incident from those fresh toothpicks on the floor. Where a man in a hurry searches for a match he invariably finds quantities of toothpicks. I would"——

"Are you through with that 'phone?" asked a short, stout stranger appearing suddenly at the door and vigorously puffing a cigarette, "because if you are I"——

"Certainly, sir," said the analyst, smiling. "I think you will find the freight office disengaged at present."

"Well, I'll be hanged!" said the friend.

Disastrous Result of Poor Telephone Service.

Two prominent insurance men in St. Louis became involved in a dispute which eventually required the offices of a police magistrate to adjust. The local papers printed graphic descriptions of the encounter and the whole town was stirred up over the affair. It was a story of how two telephone wires got crossed; how somebody called somebody else a liar; how the wrong man resented the insult and smote an innocent third party in the mouth, breaking off two teeth and causing severe loss of blood and great physical pain and mental anguish; how the smiter was pursued with a horsewhip around the block by his victim, and finally ran into the arms of a big policeman, and how justice miscarried through the inadvertent mixing of the First and Second District Police Courts. The unfortunate incident might have been averted by the use of a modern telephone system in St. Louis.

Exchange Apparatus.

The accompanying cuts illustrate a new toll-line switchboard just gotten out by the American Electric Telephone company of Chicago. The drop used is the company's latest improvement in the tubular high-impedance drop, and is extremely sensitive. The close adjustment of armature to core without being interfered with in removing the coil adds greatly to its efficiency. The coil is adapted for toll-line work and is also acceptable where the Bell style of switchboard is wanted, that is, in boards where the drops and jacks are separated. Another feature illustrated is the jack used in this board. It is simple in construction and durable. All springs are of heavy german-silver, and it is fastened to the switchboard in a most simple and positive

EXCHANGE APPARATUS.—PLUG AND JACK.

manner. The plug is also new. The tip screws into the handle in such a way that connections are made from cord to tip through the plug handle without the necessity of soldering cord circuits. This is important, as exchanges frequently have trouble in the breaking of cord circuits where they are connected to plugs.

The cam is of a new design. Only one lever is used in listening and talking and ringing either way. The mechanism is novel, practical and substantial and may be rapidly operated.

The head-band receiver shown is made of aluminum, self-adjusting to the head. The spring is covered with leather and is light.

The Southwestern telephone line from Galveston to Beaumont works through 16,650 feet of submarine cable, reaching from Galveston to Bolivar Point. This is the longest submarine line used by any telephone company in the United States. The capacity of the cable does not seem to affect the working of the line, and there is said to be no appreciable difference that would indicate whether it was working overhead or through cable.

Extensions and Improvements.

The new telephone company in St. Joseph, Mo., now has 307 subscribers and the number is increasing daily.

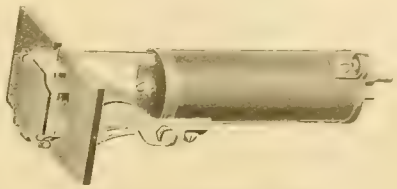
Under direction of District Manager John Bar-

EXCHANGE APPARATUS.—HEAD BAND RECEIVER.

ricklo, a new telephone wire is being stretched to Sebastapol, Cal.

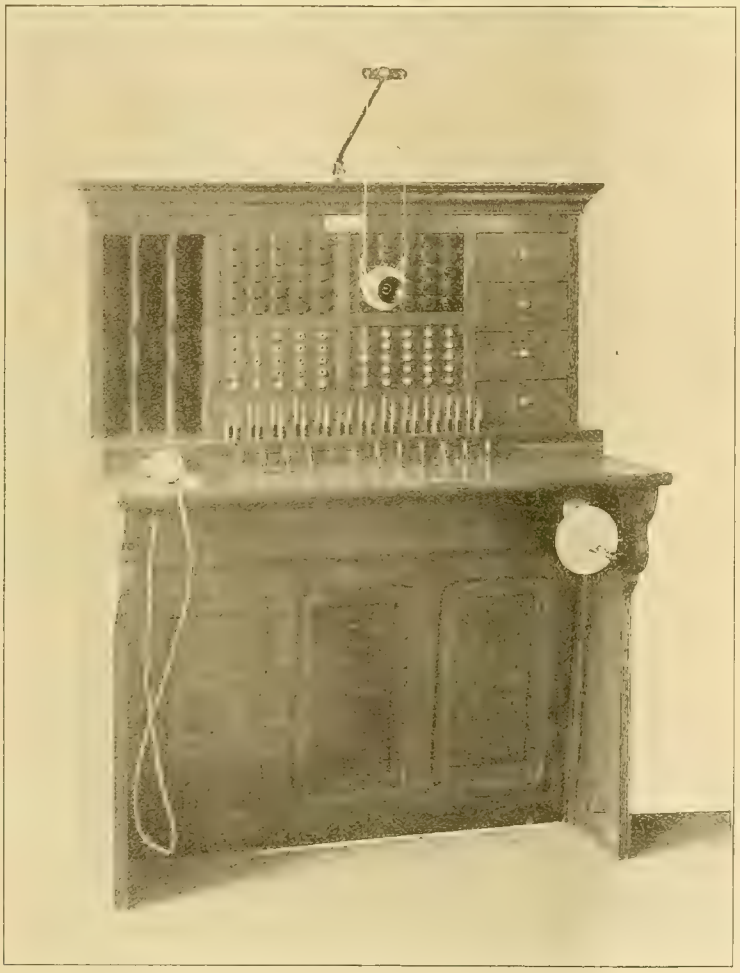
A scheme is said to be on foot to buy up and consolidate into one system all the local telephone lines of central and eastern Kentucky, numbering about 25, extending as far north as Maysville and south to Somerset.

The Logansport Mutual Telephone company of Logansport, Ind., which is owned and operated by E. B. Overshiner, has made extensive improvements within the last three months. The central office has been entirely equipped with new apparatus, including a 500-line metallic switchboard of the express type manufactured by the American Electric Telephone company of Chicago. A new cross-connecting board of 600 metallic line capacity, new trunking boards, 1,800 feet of additional outside cable, new cable terminals and everything necessary for modern first-class service. The Mutual Telephone company has also long-distance connections with many towns and cities in Indiana and Illinois. Thirty of these connections are independent exchranges. Following is a list of these connections: Atlanta, Arcadia, Argos, Attica, Ambia, Akron, Atwood, Burlington, Boyleston, Bass Station, Bearss, Beaver City, Boswell, Bourbon, Bremen, Brock, Brookston, Burnettsville, Camden, Clymers, Cutler, Circleville, Cedar Lake, Colfax, Cameron Springs, Clarks Hill, Crawfordsville, Chalmers Chase, Darwin, Delphi, De Motte, Darlington, Donaldson, Etna Green, Frankfort, Flora, Fair Oaks, Fowler, Foresman, Francisville, Fulton, Goldsmith, Goodland, Gladdens Corner, Glen Hill Grant, Grovertown, Hillsboro, Hamlet, Hibbard

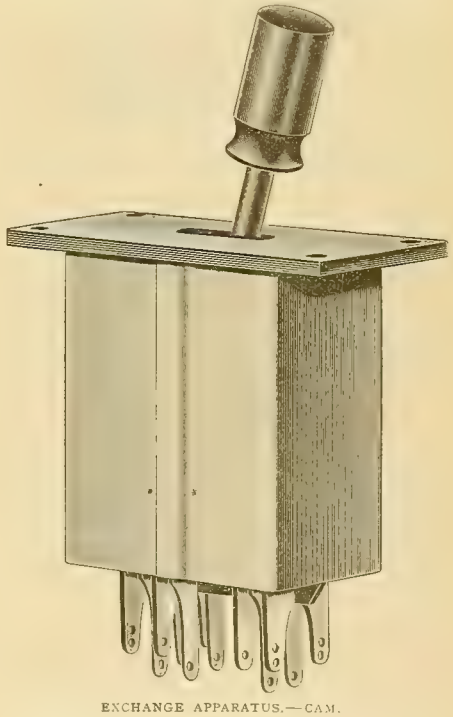


EXCHANGE APPARATUS.—DROP.

Idaville, Inwood, Jefferson, Kewana, Kempton, Killmore, Knox, Kentland, Kenneth, Kniman, Kirkpatrick, Lee, Linden, Lake Village, Lochiel, Lake Cicott, Lafayette, Moran, Marmont, Macy, Meta, Moroco, Monon, Montmorenci, Monticello, Medarysville, McCoysburg, North Manchester, Odells, Ora, Otis Ranch, Otterbein, Oxford, Oakley, Oswego, Piermont, Pine Village, Parr, Pleasant Ridge, Pearcy, Pembroke, Plymouth, Pulaski, Rockfield, Rossville, Remington, Romney, Royal Center, Reynolds, Rose Lawn, Rochester, Rensselaer, Sedalia, Stockwell, Shadeland, South Raub, Surrey, Shawnee Mound, State Line, Star City, Tipton, Templeton, Thorntown, Tiosa, Wabash, Warsaw, Wadena, Wagoner, Walkerton, Winona, Wingate, Winthrop, Williamsport, Wheatfield, Westpoint, Winamac, Yountsville, Valparaiso, Sheldon, Ill., Watseka, Ill., Danville, Ill. The Mutual company will build long-distance toll lines extensively in the spring, giving to the people of Logansport and surrounding towns excellent long-distance service in addition to the present connections. Mr. Overshiner opened his exchange in Logansport three years ago with 182 subscribers and not a single outside connection. The exchange now numbers over 500 subscribers and has nearly 500 miles of toll lines.



EXCHANGE APPARATUS.—TOLL-LINE SWITCHBOARD.



EXCHANGE APPARATUS.—CAM.

Slot Telephones in Chicago.

The Chicago Telephone company has several hundred slot-machines in drug stores, hotels and other public places for the use of the public. A charge of 10 cents per message is exacted, the company receiving the greater part, if not the entire receipts of the machine. It has been learned that the company has no right to put in telephones of this character, and that it has no right to exact payment for single messages under its franchise. The corporation counsel has advised the City Council that the company is violating the terms of the ordinance under which it is operating in several important particulars, and a council committee last Monday evening recommended that the terms of the franchise be enforced and that the corporation counsel be instructed to proceed at once under the ordinance.

"The Greatest Discovery of the Age."

When England set her navy afloat upon the sea,
She had no anticipation of my great discovery.
For 'tis I, the only I, that have made her ships but scrap.
Any nation now may whip her, e'en the smallest on the map.
By "the greatest discovery of the age."

For the blowing up of navies will now be only fun.
An exertion of my will or thought and, lo! the thing is done!
I've combined a wireless telegraph and torpedo dirigible
In so evident a fashion, some say not patentable,
My "greatest discovery of the age."

I care not if the whole shebang was generally known,
I'll be very much *offended* if 'tis not *now* my own
I'm a Christian and philosopher, as I have truly said;
The laurels of undying fame are resting on my head
For "the greatest discovery of the age."

And when I *am* offended, my forgiveness is complete
When I get a full apology, with humbleness replete.
I've put a stop to wars, but do not rest my claim
On such a simple act as that for everlasting fame.
My super-extra glory rests upon the arts of peace,
I'm in for killing whales and sich and getting at their grease
By my "greatest discovery of the age."

I'm so struck on this my latest that my brain it fairly reels,
And my head it gets to spinning as it 'twere hung on wheels.
I had an oscillator once, a tuneful dynamo,
A revolution 'twas to make, by vibrating to and fro.
'Twas a very great discovery of the age.

But it died ere it was born and resteth as a myth,
And its name now means some coils I experimented with
As another great invention of the age.

To shake the charge of mother earth, another scheme of mine
Beats thunderstorms and earthquakes, all along the line.
But wait till 1900. O, won't the people talk,
When I blow up stuff at Paris, when I think so at New York,
By my "greatest discovery of the age!"

I've labored with high frequency to publish and proclaim
That I own some great discoveries, connected with my name;
By high-potential discourse I've tried to bring to light
That there weren't any others who contributed a mite
To such very great discoveries of the age.

But the shade of Cabanellas, and of many others too,
Are upsetting my endeavors, and proving my hoodoo.
I content myself in this, that the papers of the day
Will print my schemes sensational and boom me by the way
As "the greatest discovery of the age."

Electricity's Mystery.

[From Collier's Weekly.]

Mr. Tesla's announcement that he is prepared to destroy a ship by means of electricity, yet not by means of wires, has been received with cheerful incredulity. It is a bountiful Providence which has enabled man to ridicule what he does not understand. Ridicule has been the prelude of every great invention. It has crooned at its cradle. But though it came to jeer, again and again it has remained to stare. That is as it should be. The beginning of truth is amazement. But in this case, as in all others, the proof of the pudding is in the eating. The value of Mr. Tesla's process remains to be shown. Just at present it is a mystery. Yet, so also is electricity. No marvel which electricity has worked is as marvelous as electricity itself. To call it a mystery, though, is a misuse of language. Correctly speaking, there is no such thing; but there is ignorance, and it is in a manner both delightful and flattering to general self-esteem that the one is confused with the other. In the chartless morrow which the future has in charge it is not extravagant to assume that ignorance will evaporate, knowledge become exact, that electricity will yield its secret, and perhaps for those who then live fathom the recesses of the sky. From a servant it may develop into a confidant; it may tell of its wanderings, of its conception, of its sudden avatars and all that it has seen. But this is conjecture. The point is, that in manipulating it, with a wire or without, there is a difference in degree rather than in kind.

Treatment of Inventors.

[From the Mansfield, O., News.]

Tesla, the electrician, whose promises excel his performances, has been having a few words with the editor of an electrical journal and has come out second best. If he thus fares with one of the brethren in his own line troublous times are ahead for him if he tackles the laymen of the press, who are ever ready to give the glad hand to an inventor who invents, but who are rather merciless on those long on talk and short on deeds, whether they be inventors or politicians.

Tesla's Fears.

[From the Anaconda, Mont., Standard.]

Tesla has satisfied himself and is trying to satisfy others that he has discovered a principle, the application of which 'must produce a profound change in things and conditions presently existing." Tesla's only fear is that his invention will be used by men for evil purposes—that, like the invention of gunpowder, it will not be an unmixed good to the world. But it is a comfort to him to know that, for one thing, it will abolish war.

Tesla's Romances.

[From the Minneapolis Times.]

Tesla has administered a severe scolding to the editor of an electrical journal, who intimated that Mr. Tesla might find it profitable to give his imagination a rest and finish up some of the wonderful things he has set out to do. In these days of scientific miracles it isn't safe to be skeptical, but some of those announcements of Tesla's read as if they might have been inspired by the product of the poppy in the pipe.

High-voltage Power Transmission.

By Chas. F. Scott.

Part III.

High-tension Tests at East Pittsburg.

Laboratory tests and measurements on a small scale cannot take the place of tests under the conditions of practical service, such as those at Telluride. There are, however, many important elements which may be determined by laboratory measurements.

A high-tension line for testing insulators and making measurements upon the losses between wires was erected at the East Pittsburg factory in the fall of 1897. A number of the tests which have been made are here recorded:

(1) A test was made to detemine whether the wave form of the charging current to the line was similar to that through a resistance or whether it was modified by the loss component, the loss occurring only at the higher part of the electromotive-force wave. The current to the high-voltage line, at pressures varying from 30,000 to 60,000 volts, was passed through a coil possessing high self-induction. The electromotive force upon the coil was measured by a voltmeter. The electromotive force was also measured when a current of equal strength was passed through the coil, the line being short-circuited and a low electromotive force applied. It was found that the voltage upon the coil was the same, within a small error of observation, in both cases, showing practically no difference in the wave form of the current under the two conditions. The current was from an armature giving practically a sine wave.

(2) The charging current to the line was measured

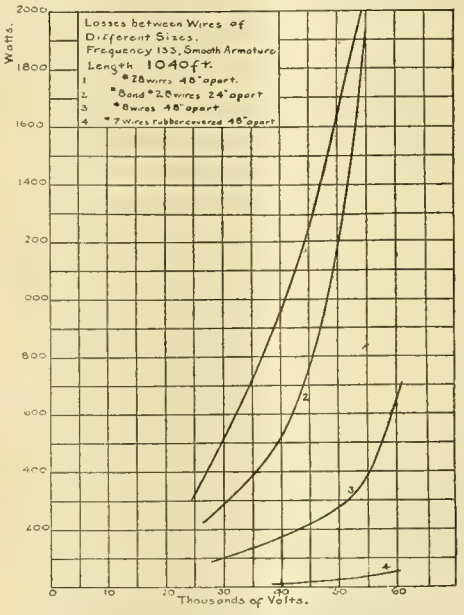


Fig. 13.

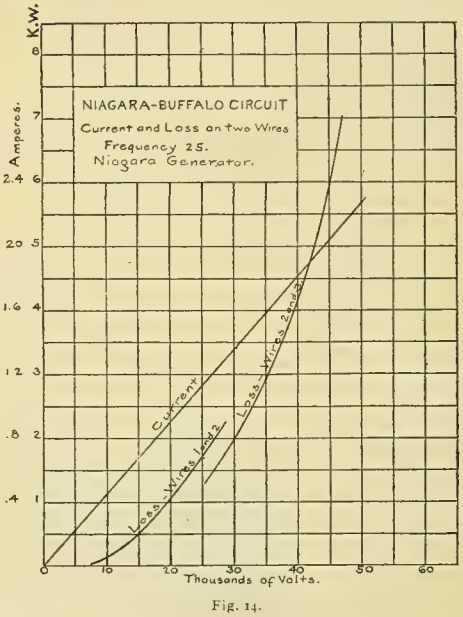


Fig. 14.

HIGH-VOLTAGE POWER TRANSMISSION.

under several different conditions when the current was obtained from a generator giving practically a sine wave. The results of measurements were compared with the currents as calculated by the theoretical formula. The last measurement in the table was made upon the Buffalo-Niagara line, with current from a Niagara generator, which differs slightly from a sine wave.

Comparison of Measured and Calculated Charging Current to Parallel Wires. Length, One Mile—10,000 Volts.

Size of wire	Distance between wires.	Frequency.	Measured current.	Calculated current.
No. 8 B and S	21.7"	60	.0307 amp.	.0280 Amp.
8 B and S	48.0"	60	.0215 "	.0252 "
8 B and S	79.5"	60	.0234 "	.0238 "
8 B and S	127.5"	60	.0225 "	.0222 "
No. 8 and ground	120 0"	60	.0427 "	.0412 "
0.71" diameter	18" for 3 dis. / 36" " 3 " 1	25	.0176 "	.0176 "

A table giving the calculated charging current for a number of conditions will be found in Appendix B.

(3) The fall of potential around the wires was noted by tests made with spark-gaps. The wires 48 inches apart were connected to the high-voltage terminals and a spark-gap was placed between two idle wires, also 48 inches apart, placed about 21 inches below the first wires. A spark-gap consisting of brass terminals with one-fourth-inch radius was placed between the two idle wires. When the gap was one-thirty-second inch the sparking began when the electromotive force from the raising transformer was 26,000 volts. A gap of one-thirty-second inch requires an electromotive force of 2,200 volts to produce sparking. When the spark-gap was made eight-thirty-seconds inch (equivalent to 12,000 volts) the sparking began at 103,000 volts from the raising transformer. At intermediate points there is a fair proportionality between the spark-gap and the electromotive force.

In another test a spark-gap was placed between one of the idle wires and the adjacent wire of the live circuit. When the spark-gap was one-eighth inch (equivalent to 6,000 volts) the spark passed when the electromotive force was 17,500 volts, and when the spark was made one-fourth inch (equivalent to 12,000 volts) the sparking began at 33,000 volts. When the gap was three-eighths inch (equivalent to 16,000 volts) sparking began at 41,000 volts. When the gap was one-half inch (equivalent to 20,000 volts) sparking occurred at 49,000 volts. The electromotive force did not differ greatly from a sine wave. These tests have an important bearing in connection with the running of telephone and other circuits adjacent to high-potential wires. It is essential that the wires of a high-potential circuit be spiraled, so that each wire sustains the same relation as every other wire to the second circuit, in order that the effects of static induction may be neutralized.

(4) the effect of the size of wire upon the loss was investigated by running a pair of No. 28 brass wires 0.0126 inch in diameter and then replacing it by large rubber-covered wires. The rubber-covered wire was No. 7 B. & S. gauge 0.144 inch in diameter; the outside diameter of the rubber covering was 0.3 inch and the diameter over the braid was 0.35 inch. In each case measurements were made upon another circuit, which was unchanged during the different tests, and thus served for comparison. The results of these tests are shown in Fig. 13, which also gives the conditions when one fine wire and one wire of larger size, No. 8 B. & S., constituted the circuit. This comparison shows the very marked increase in loss when the fine wire is used. The loss is greatly decreased when the rubber-covered wire is used. The loss on the rubber-covered wire, however, increased considerably after the voltage had been raised and the rubber had broken down, thus permitting the current to pass freely to the outer surface of the insulation. It is quite probable that the loss would increase as the insulation became defective, until it was nearly equal to that of a wire having the same total diameter.

The measurements on wires of different size given in Fig. 13 are qualitatively correct, although some of the readings on which the curves are based were quite small, so that the absolute values may not be exact.

(5) The effect of the current in drying the surface of the insulators was illustrated in a test made during a rain. Upon applying 45,000 volts to a circuit the wattmeter indicated 116. After four minutes the deflection had decreased to 72, the current remaining the same. The electromotive force was then increased to 60,000 volts, the wattmeter deflection increased to 155, and at the end of three minutes it had fallen to 138. The current was one-third greater than at the lower voltage, but remained constant while the wattmeter changed. The rain continued during the test, which shows, therefore, that the condition of the insulator is materially improved by the presence of the current.

(6) It was noticed that when there was a breakdown upon the line and the current passed suddenly between wires over the surface of the cross-arm that there was a sparking between the terminals of the ammeters in the high-tension circuit across the surface of the instrument. This was further investigated by placing in circuit a coil of low resistance through which one ampere would be sent by about 1½ volts at a frequency of 125. A spark-gap was placed in shunt to this coil. A two-inch spark-gap was also placed between the line wires. The voltage of the primary was gradually raised until, at 35,000 volts, the current passed across the

spark-gap between the line wires. A spark also passed across a gap of three-eighths inch, shunting the small choke-coil. This test shows the remarkable suddenness of the rush of current when the short circuit occurs, due to the breaking down of the spark-gap on a high-voltage circuit. This phenomenon was observed by Mr. Mershon in choke-coils used in connection with lightning arresters at Telluride.

Running tests were made on four lines in multiple at high voltages. Each line consisted of two wires 1,040 feet in length held by 26 insulators. The insulators were of various types of glass and porcelain, some of the ordinary form and some underhung. For hours at a time 100,000 volts or slightly more was kept upon the line. For about six weeks voltages ranging from 70,000 or 80,000 to 100,000 volts were kept on the lines for about eight hours a day. When there was rain the line would short-circuit and the voltage had to be reduced. During a driving rainstorm 48,000 volts was kept on the lines, and it may have required a considerably higher voltage to have caused short-circuiting.

(7) A high-tension wattmeter, similar to the Thomson wattmeter at Telluride, was used. To correct the wattmeter for the errors caused by charging current in the shunt resistance, a condenser was placed in parallel to the shunt circuit of the wattmeter. This condenser should be so adjusted that the current through the shunt circuit of the wattmeter is the same that it would be if there were no condenser and the shunt resistance had no capacity. This permits the capacity current in the circuit to be shunted round the wattmeter by the condenser. The condenser in shunt to the wattmeter was capable of adjustment, and by varying its capacity the deflection could be made positive or zero or negative when current was delivered to a constant load. The

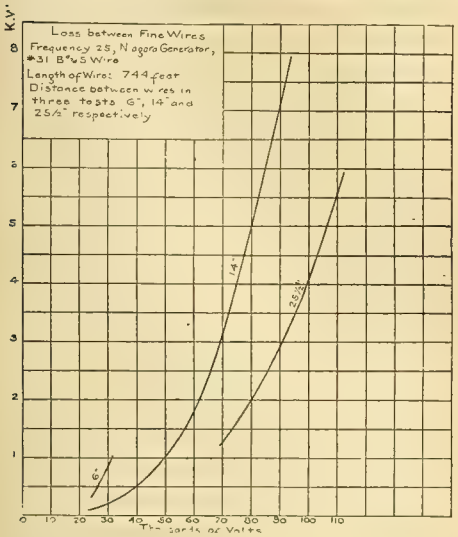


FIG. 15. HIGH-VOLTAGE POWER TRANSMISSION.

proper adjustment was made by taking a comparatively low voltage, at which the charging current was very high in comparison with the loss, so that the loss was nearly negligible, and adjusting the wattmeter to indicate zero. At higher voltages, when there was a considerable loss, the error with this adjustment would be inappreciable. Certain variations with temperature and humidity were noted which would be explained by a variation in the capacity of the resistance, causing a variation in the charging current to the shunt circuit of the wattmeter. The high resistance for the shunt circuit was wound upon fuller-board plates, containing brass stiffening pieces. Tests were made upon individual plates by measuring the capacity between the wire and the supporting strip of brass, and it was found that the capacity and the insulation resistance both varied with the amount of moisture in the fuller-board insulation. In order to prevent variations of this kind, subsequent resistances were wound upon glass plates, which seems to be a very satisfactory form of construction.

Tests at Niagara

Some measurements have been made upon the Niagara-Buffalo transmission line. There are two circuits of three wires each, one of which was in service and the other was available for tests. Each circuit consists of three cables, each of 350,000 circular mills, approximately 0.7 inch in diameter. The cables are run on porcelain insulators, and are on the same cross-arm. Adjacent insulators are 18 inches apart and the circuit is spiraled, so that each of the three wires occupies the middle position for a third of the distance. Current from one of the 5,000 horse power generators was applied to the line through a raising transformer, by which the voltage can be increased by small steps to 100,000 volts. This transformer is part of a high-tension testing outfit which was described by Mr. C. E. Skinner in the Electrical World, March 5, 1898. The wattmeter is a Thomson inclined-coil instrument with a high-resistance shunt of german-silver wire wound on glass plates. The ammeter is a Thomson inclined-coil intrument, connected directly in the high-voltage circuit.

Measurements were made between the various pairs of wires, i. e., 1 and 2, 2 and 3 and 1 and 3; the current was found to be practically the same in each case; the loss on one of the circuits was slightly greater than that on either of the other two, on which the losses were about equal. The accompanying curve shows the measurements of current when two wires were connected and the measurement of loss; the latter measurements were made upon one pair of wires up to about 26,000 volts, and then upon a second pair. The results are given in Fig. 14.

On another day measurements were made of the resistance between each wire and the ground, and corresponding measurements of loss were made by placing the high potentials between each wire and the ground. The measured loss was somewhat greater than the loss calculated by using the electromotive force and the measured resistance. In these measurements, at voltages from 13,000 to 23,000 volts, the power factor calculated from the current and wattmeter measurements varied from about four per cent. to six per cent., so that a very small charging current in the wattmeter would produce a considerable error in the reading.

Some measurements were made upon a pair of fine wires, in which the wires were placed at different distances apart. No. 31 B. & S. gauge spring-brass wire 0.0089 inch in diameter was used. The length of the parallel wires was 744 feet. They were suspended by light strings successively at six inches apart, 14 inches apart, and about 25 inches apart, the distance varying from 24 inches to 27 inches. The wattmeter readings are given in the curves in Fig. 15. The power factor of the measurements made above 100,000 volts is about 95 per cent., and is over 80 per cent. above 70,000 volts. There can be but little error in the wattmeter due to charging current in the resistance at these power factors.

The measurements on the Buffalo line were made by the writer. Those on the fine wires were made by Mr. E. M. Tingley, who conducted the tests at East Pittsburg, and rendered valuable assistance in the preparation of this paper.

New Lamp Factory in Chicago.

Buyers of incandescent lamps will be interested to know of the establishment of an incandescent-lamp factory by the John Kammer company at 176 and 178 Indiana street, Chicago. This concern is now manufacturing under the personal supervision of John Kammer, who formerly managed the factory of the Sunbeam Incandescent Lamp company of Chicago. The "New Rival" is the name of the lamp now being placed on the market by the company.

Mr. Kammer has had 10 years' experience in the manufacture of incandescent lamps, and the new lamp will be the only one now produced in which Mr. Kammer's patents and processes are used.

The officers of the company are: President and treasurer, John Kammer; vice-president, Paul J. Faber, and secretary, B. Kammer.

The factory at 176-178 Indiana street is a fine one of three stories. The plant contains the latest modern machinery, through which the manufacture of incandescent lamps has been brought to the present state of perfection, necessitated by the stringent demands of the incandescent-lamp market of to-day.

The company started its plant about four months ago and has worked in a conservative manner in the manufacture of its product up to date, but it is now in position to reach out for trade, and the "New Rival" will be made known to lamp users throughout the United States, and more particularly in its home territory.

In addition to the standard "New Rival" lamp now manufactured by the company, specialties are made of two, four and six candle power lamps for 50 and 110-volt circuits. Mr. Kammer has also perfected the "New Rival central-station lamp," which will run about one-third of an ampere per lamp on a 110-volt circuit.

From the fact that Mr. Kammer in person attends to all details of manufacture and is in daily supervision of his factory, attending not only to all technicalities but looking after the general management and shipping, it is safe to say that customers of the new concern will find the filling of orders thoroughly satisfactory and the claim of the company one worth careful consideration.

Motor for Blowing Forge.

An interesting application of an electric motor is illustrated in the accompanying cut, which represents a small machine, manufactured by the Emerson Electric Manufacturing company of St. Louis, employed in blowing a forge. The makers claim that this is not only the cheapest but is also the best method of furnishing blast for all sizes of blacksmith forges. The air pressure is very much heavier than can be procured from bellows or hand blowers, and, in addition, it allows the workman to do at least one-fourth more work, as the blast is ready at all times, and it is not necessary for him to devote any of his time to producing the air pressure. A great many of these equipments are in use in the largest blacksmith shops in the country, and are giving universal satisfaction. With its use it is possible to get an even welding heat on a four-inch axle much quicker and better than can be done by any other system.

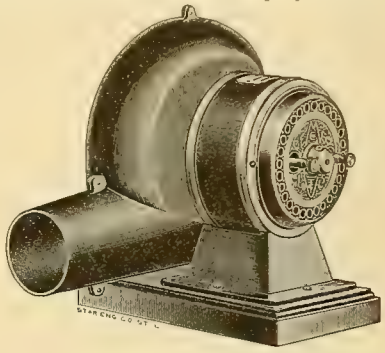
Work of the Weather Bureau.

Over 4,000 telegrams were sent from the weather bureau Sunday morning to different towns and cities along the north Atlantic coast notifying railroad companies, street-railway companies, steamship managers, boards of public works and other city officials and postmasters, for the information of the public, of the approach of a terrible hurricane, which originated in Texas Friday night, December 2d, and had been moving in a northeasterly direction at the rate of about 35 or 40 miles an hour, gaining in violence very rapidly until it had become one of the most extensive and devastating storms that had occurred for several years, covering an area of the entire country east of the Mississippi River. It was much more severe than the blizzard of the previous week, and the Weather Bureau was therefore very urgent in its warnings to shipping not to venture from safe shelter. William E. Curtis, the Washington correspondent of the Chicago Record, says that the warnings of the last gale were received by over 700 vessels on the North Atlantic coast alone, and among others the Portland, which refused to heed it, and went down with all on board.

Between 8 and 9 o'clock Sunday morning the whole telegraph system of the United States, every wire of both the Western Union and Postal companies, was in use by the Weather Bureau for the purpose of notifying the public of this storm.

St. Louis Street-railway Consolidation.

The St. Louis Globe-Democrat of Tuesday contains the news that the largest street-railway deal in the history of St. Louis is practically closed. By the transaction Corwin H. Spencer and other stockholders of the Southern Electric Railway company will become owners of all the lines and equipment of the National Railway company of Chicago, better known as the Hamilton syndicate, organized under the Illinois statutes in 1889. D. G. Hamilton of Chicago is president and the principal stockholder. For the past three years the company has declared



MOTOR FOR BLOWING FORGE.

six per cent. dividends on its stock of $2,500,000. The report of the sale is confirmed by Mr. Spencer, president of the Southern Electric company. He preferred to withhold the figures representing the purchase price at present. The property sold includes the Northern Central, Cass avenue and Fairgrounds, Union, Citizens', Baden and Southwestern lines, all electric, and the St. Louis line, or Broadway cable. It represents 95.04 miles of track, of which 80.37 miles is electric and 14.67 miles cable.

Surface-contact Electric Railways.

[*Continued from page 327.*]

The latest candidate for honors in surface-contact development is Professor Silvanus P. Thompson, who endeavors to combine the good points of the electromagnetic switch system with the good elements of the pure magnetic pick-up system. The result is, however, not a happy one, as it involves the switch in complication, whereas every engineer and mechanic knows that an essential condition of infallibly operative mechanism is that it shall be reduced to the last stage of simplicity, viz., a weight falling in free air.

As these multifarious steps in the evolution of the art have been taken, it has become more and more apparent than the positive-acting electromagnetic switch, energized directly by an ample electric current and possessing, as it does, the quintessence of mechanical and electrical strength and simplicity, will alone yield the positive and reliable results demanded in railway work.

Moreover, as it has been found that a certain "time allowance" for the operation of the switches is essential for high-speed work, a duty requiring the switch to operate before it is reached by the contact shoe of the car, it is, of course, apparent that since the electromagnetic switch is the sole device capable of responding at a distance, it alone is equal to such duty.

Mr. Lundell and I have from the outset recognized these severely exacting conditions and have, accordingly, based our work entirely upon the electromagnetic switch and sought to reduce it to the acme of simplicity and consequent reliability, as well as to evolve a system of circuit connections equal to every requirement of speed, direction, capacity, economy, reliability and safety. These results we

not only claim to have achieved, but, in doing so, to have produced a system so inexpensive as to justify its adoption wherever the overhead trolley is now financially successful.

Electrical Equipment at McGill University.

Professor R. B. Owens is engaged in extending the course and adding to the equipment of the electrical department of McGill University. In the laboratory the dynamo and motor equipment will be rearranged, and all machines, instead of being permanently fixed, will now be mounted on testing blocks, so that it will be possible to move them about from place to place. A special crane for the purpose of carrying the machines about the laboratory has been supplied. There are also being constructed a number of testing tables permanently wired up to facilitate experimental work. The number of accumulators or secondary batteries already owned by the department has been increased and a number of high-potential transformers has been added. A large number of modern alternating and direct-current instruments has also been provided. The wiring for the laboratories will be done under the floors and testing blocks, and distributing boards will be used, so that it will be possible to throw any individual laboratory on to any circuit. For the purpose of carrying on the testing of street-railway motors, batteries have been arranged for furnishing high potential or a large amount of current. There has also been provided a number of specially designed electrical speed indicators for extremely accurate measurements of speed. These instruments have been worked out by Professor Owens himself and have been constructed to give an instantaneous speed of one-fifth of one per cent. Alternating-current machines giving one, two and three-phase currents at frequencies varying from a few periods per second to 150 periods per second, a number of two and three-phase induction motors, and a number of transformers for changing two-phase currents into three-phase, have also been installed. It has been decided to establish a standardizing laboratory, thoroughly equipped with all necessary primary and secondary standards for electrical and magnetic measurements. In this way it will be possible to calibrate quickly all instruments used in the laboratories, and the department will be in a position to do a limited amount of standardizing work for commercial electrical concerns. A separate laboratory will be equipped for tests and investigation work, and, if possible, arrangements will be effected with manufacturing companies whereby the university will have the use of new types of machines. In this way the students will be kept in touch with the latest developments of electrical machinery.

Municipal Lighting Plant for Rochester.

The city of Rochester, N. Y., has excellent street-lighting service and the people have been proud of it, but the mayor thinks the expense is too heavy, and accordingly he is advocating a municipal plant. In a recent communication to the Common Council he said:

"There can be no question but that our city is one of the best lighted in the United States. I believe that we have more lamps, particularly in the center of the city, than are necessary. Had the lamps been located as they should have been, the outskirts of the city would have been better lighted. The cost of lighting our city for the year ended March 31, 1893, was $163,547.83, while for 1898 the cost will be nearly $230.000, an increase in that short period of $66,426. It may be readily seen that our street lighting is costing us a large amount of money. In fact, without any further increase, we shall be compelled to pay $1,000,000 for this purpose every four years. I believe that it would be for the best interests of our city to take steps toward the construction of a municipal light plant and have it ready for operation at the termination of the present contract. The interest on the cost of the plant could be paid, its operation and the depreciation of the plant provided for, and lights for our streets, together with the necessary lights for the city buildings, fire houses and schools, for which we now pay extra, could be furnished for a less sum than we are now paying."

Lighting and Drainage of New Orleans.

[From the New York Sun.]

The establishment of pumping stations is one of the largest items in the cost of establishing drainage and sewerage in New Orleans. The city is like a leaking boat; it can be kept dry only by constant pumping. But these pumping stations have been discovered to bring another advantage to the city. When the question of their construction and operation first came under consideration, the council invited bids for their operation, either by steam or by electricity. There was so little difference in the cost that the bid for electricity was accepted. The contractor is now building and has nearly completed the power house whence will be distributed the power that will operate all these immense pumping stations. It has been developed that the power house will turn out a great deal more power than is needed for the pumping, and the pumps will be idle many days when there is no rainfall, and consequently, no water to carry off. An examination by the city engineer has proved that the central pumping station will easily develop enough power to light New Orleans by electricity, and that the city can supply its own lights at a minimum of extra cost. Thus, while solving the sewerage and drainage problem, it is solving that of illumination also.

Electrical Imports in the Argentine Republic.

According to the official figures furnished by the Argentine customs office, there has been a great increase in the use of electricity as a motive power and for lighting purposes within the bounds of the republic for the first six months of 1898. The gold valuation of the imports of electrical appliances during the period named is given in the following table:

Cables, wires, etc. (2,090 tons)	$524,081
Electric-light material	191,565
Fittings for lights (38 tons)	55,791
Dynamos (38)	28,005
Incandescent lamps (4,466 dozen)	13,398
Telegraph material	11,298
Telephone material	4,533

A large percentage of these supplies was purchased from firms in the United States.

CORRESPONDENCE.

New York Notes.

New York, December 5.—Another severe storm crippled the telegraph service of this city last night. It was marked by a gale from the northeast and a heavy rainfall. The effect of the hurricane was very evident upon the wires of the telegraph companies. Early in the evening Chicago was lost to the East, and ineffectual efforts were made to reach it through the South by way of St. Louis. Only four wires remained to the Western Union company. As the storm advanced into New England, reports came in that the wires there were working badly. Philadelphia, too, was cut off entirely early in the evening.

During the storm there was a great fire on Broadway which did damage to the amount of nearly a million dollars. It started in the five-story building of Rogers, Peet & Co. at Broadway and Warren street, spread to the 16-story building of the Home Life Insurance company, and later to the 14-story Postal Telegraph building. The two tall buildings are modern "skyscrapers," and the fire excited widespread interest on that account. The corner building was completely destroyed; the Home building was badly burned in the upper stories; the Postal building escaped without serious injury. The flames caught the Postal building soon after 11 o'clock. There were comparatively few operators at work, and all escaped in safety. The elevators in this building were kept running during the duration of the fire. As soon as the fire was discovered the out-of-town offices were informed that operations would cease, and from that time on there was no work done. At the time that the alarm came there were only four or five out-of-town lines working, as the storm had interfered with most of them. The flames shot into the airshaft, and it was feared that the big building would go. The current in the dynamos in the basement was immediately turned off, and all telegraph work ceased. But the firemen had the fire under control shortly after midnight, and today it is reported that the damage to the telegraph building and plant is comparatively small.

Major Joseph H. Francis died at his home in Passaic, N. J., last week. Major Francis was born in Winchester, Tenn., in 1841. He fought with the South in the Civil War, and rose to the rank of major. For many years, and until three months ago, he was manager of the Metropolitan Telephone company of New York. Major Francis had lived in Passaic for some years. He leaves a widow, two sons and three daughters.

The American Society of Mechanical Engineers held its annual meeting in this city last week. Many noted engineers were present. Commodore George W. Melville, U. S. N., was elected president of the society for the coming year. A number of carefully prepared papers were read and discussed. On Thursday the visitors inspected the Duane street Edison station.

An advertiser in the New York papers who is exploiting a "stored steam" system of motive power offers "$5,000 forfeit to any person or company who will prove that electricity can operate the Manhattan 'L' system as cheaply as it is now being operated with the steam locomotive." This offer is intended for able and sensible experts and mechanics, we are told, not "so-called electrical experts(?) who claim to produce something out of nothing." The point of the advertiser is that its system is more economical than the steam locomotive even; therefore, how much better than electrical application! The advertisement is a curious instance of misdirected energy.

The suit of the Atchison, Topeka and Santa Fe Railway company in the United States District Court in this city, to compel the Western Union Telegraph company to pay for revenue stamps required by the war-revenue law on telegraph messages transmitted under its contract with the company, has been dismissed at the railway company's costs. The contention of the railway company was that the service which the telegraph company agreed to give to the railway company is to be free of all charges. The telegraph company's contention was that the "maker, signer or issuer" of telegraph messages must affix and pay for the stamps. M. S.

New England News.

Boston, December 3.—An event in the construction line that will prove scarcely less important than the building of the subway in this city came to the front last week. Bids have been invited for the first section of the tunnel, between the city proper and East Boston, which is built on an island. This section will be the opening one from Maverick square over in East Boston, and will include an incline open 139 feet and 233 feet of double-track subway. The object is to promote rapid transit, and electric cars of the Boston street-railway system will run through the tunnel, which will go under the harbor practically on the route of the South ferry. In many respects the tunnel will resemble the present subway in construction.

Recent franchises for street-railway companies include one to the Boston and Needham Street Railway company by the Dedham, Mass., selectmen from the Needham line to West Roxbury, through Dedham, a distance of about four miles. A new street electric system is also projected for the towns of Holbrook and South Weymouth, Mass. The selectmen of Whitman, Mass., have voted to reissue the franchise for a road connecting through that town with Brockton and the south shore beaches. The franchise originally granted was not availed of by the promoters of the project, but new capital and other promoters have been enlisted in the venture, and it is now likely to succeed.

The Plymouth and Sandwich Street Railway company has filed a certificate that its capital has all been subscribed and 50 per cent. paid in. The Webster and Dudley Street Railway company has filed its certificate that its entire capital is paid in. These are Massachusetts corporations.

The railroad commissioners have authorized the increased issue of $100.000 stock and $50.000 in five per cent. 20-year bonds by the West Roxbury and Roslindale street railway. The issue is for funding floating debt for extensions and equipment.

An electric railway between Burlington, Vt., and Hinesburg, in the same state, has been begun. It will be 15 miles long and is intended for both freight and passenger business.

The Boston Electric company has leased the five-story building at the corner of Harrison avenue extension and Exeter place, in this city, for a term of 10 years.

Expert testimony regarding the effect of electric currents upon underground gas and water pipes was an important feature of the testimony in the suit arising over injuries sustained by one of the victims of the big explosion at the corner of Boylston and Tremont streets, when the subway was under construction. The responsibility for damages on account of the accident has never been fixed, and the court is trying to discover whether the gaslight company, the railway company or the construction company is to be held accountable.

C. S. G.

Detroit, Mich.

Detroit, December 5.—The storm of yesterday caused about $100,000 damages to the telegraph and telephone companies in the city and state. At this date, Monday, the only outside telegraph connection the city has is with Toledo. Chicago on the west and Buffalo on the east are cut off, and neither the Western Union nor Postal company promises any connections for several days. On Grand River avenue the poles were broken off close to the ground for a distance of three miles. The wires were strewn all over the street, and street-car traffic was impossible. There was little wind, but the snow clung to the wires and formed a thick coating of ice until the weight dragged them to the ground. The street-car service was badly crippled. Only two divisions of the Detroit railway were in operation. The snow was heavy, and none of the cars of the Citizens' Street Railway company could push through it.

A city railway fight is in progress between the Citizens' Street Railway company and the Common Council. The aldermen want eight tickets for a quarter with universal transfers on all lines in the city, upon the basis of a 30-year franchise. The company states positively that it will only allow the concession upon a five-cent fare, including a new franchise for the Detroit electric railway abolishing the eight-tickets-for-a-quarter franchise and making it a straight five-cent fare. The company states that it is losing money on the cheaper fare.

The Wyandotte, Trenton and Detroit electric suburban railway has been sold to J. C. Hutchins and A. B. Du Pont of the Citizens' company. It is said that Tom Johnson money is back of them in the new deal. The new owners assumed active charge of the road on December 1st. G.

PERSONAL.

Gen. Frank V. Greene, who has been selected for governor of Havana, is an engineer by profession. He graduated at the head of his class at the United States Military Academy in 1870, and served in many

important positions in the army. He has been engaged in commercial enterprises of late.

Among Chicago visitors last week was Charles F. Munder, treasurer and manager of the Davis Electrical Works of Springfield, Mass.

Mr. J. B. Entz, chief engineer of the railway department of the Electric Storage Battery company, was in Chicago last week on business connected with his department.

Sir John Fowler, an eminent English civil engineer, died on November 20th at the age of 81 years. He was consulted in relation to the heavy tunneling operations in connection with the City and South London railway and the more recent Waterloo and City and Central London electric underground railways. In 1866 he was president of the Institution of Civil Engineers.

Mr. W. L. Arnold assumed the management of the Arnold Electric Power Station company on December 1st. Mr. Arnold has had a wide experience as an electrical salesman during the last eight years. He has represented the General Electric company in St. Louis and Kansas City and was more recently in charge of the sales department of the Siemens & Halske Electric company at Chicago. On account of this training and his previous connection with the Arnold Electric Power Station company, Mr. Arnold should prove a valuable man in his new position.

Mr. Friedrich Tischendörfer, the chief engineer of the Elektrizitäts Aktiengesellschaft, formerly Schuckert & Co., of Nuremberg, Germany, is making a tour of the United States in the interest of his company. Mr. Tischendörfer is an engineer of distinction, well known to many of the electrical men of the United States. He is pleasantly remembered by the electrical exhibitors at the World's Fair, as he had charge of the important display of Schuckert & Co. at the Chicago exposition. His great searchlight on the Manufactures Building, now mounted at Fort Monroe, Va., was one of the prominent features of the exposition.

Mr. Henry L. Doherty, general manager of the Madison (Wis.) Gas and Electric company, has been awarded the Beal gold medal by the American Gas Light association for the best paper presented at the annual meeting of the organization at Niagara Falls last October. The subject of the paper for which the award was made was "How Can We Make the Use of Gas for Cooking More Universal?" Before entering the electrical field Mr. Doherty had several years' experience in the gas industry. His electrical friends will join with his old associates in congratulating him upon the recognition which it has been his good fortune to gain.

ELECTRIC LIGHTING.

The Lima and Honeoye Falls Electric Light and Railroad company has decided to take out three gas engines and replace them with coal-burning engines.

The Common Council of Medina has ratified a contract made with the A. L. Sweet Electric Light and Power company for lighting that village. The contract calls for 60 arc lights every dark night in the year until 1 a. m., for $60 apiece. One arc light is furnished free, the school buildings, village hall and engine houses are lighted free, and the lights are to be turned on at any time of night when a fire alarm is sounded. The privilege is given to change at any time to lighting every night until 1 a. m., at $70 a year per light; all night on the moonlight schedule at $80 per night, and all lights every night all night at $90 per light. The power for operating the plant is supplied by two waterwheels, one of 100 horse power, the other of 50 horse power, and can be supplemented by an engine of 130 horse power.

Dr. E. P. Stone, a passed assistant surgeon of the navy, in an official report, directs attention to the proper use of the electric light on shipboard. He thinks the subject a serious one, and says: "I have myself seen several cases in the service which I considered directly due to improper use of electric lights, and which were relieved by using the light properly placed. Dynamo men have been found to suffer from irritation and exhaustion of the retina and have been found upon appearing for re-examination to have suffered a serious falling off in acuteness of vision. This subject is the more important in that it is so easily remediable. Ground-glass bulbs and proper position of the lights will do away with all the bad effects. As yet laymen do not appreciate the importance nor understand the principles of this subject. In officers' rooms which are furnished with portable lights it is rare to see the lights placed properly. This subject of the location of the lights in the living spaces of a ship, being of so much hygienic importance, should be determined by a board of medical officers."

It is expected that the consolidation of the three electric-light companies of Baltimore will be consummated by the first of the year. The preliminaries have been completed, and the Consolidated Electric Light company, which is the name of the corporation which has been formed to take over the Brush Electric Light company, the Edison Electric Light company and the Northern Electric Light company, has engaged Col. John A. Tompkins to conduct the financial examination of the companies, and Messrs. Steele, Semmes, Carey & Bond and ex-Judge William A. Fisher to pass upon their legal status. Actual consolidation is contingent upon their report. The syndicate which the Baltimore Trust and Guarantee company agreed to form for the purpose of underwriting the $4,000,000 has been oversubscribed. Baltimore capitalists will furnish about $1,000,000 and Philadelphia about $3,000,000 of the amount. The new company will also issue $5,000,000 of common stock, which has already been practically sold. The new company will have $450,000 in cash, which will be used in improvements.

ELECTRIC RAILWAYS.

A dispatch from Dallas, Texas, December 2d, says that at nine o'clock one of the cars of the Dallas Consolidated Electric system was blown up by dynamite at Elm and Austin streets. Half an hour later another car was blown up two miles farther east. A stick of dynamite a foot long was found at the scene of the second explosion. No passengers were in the cars. The motormen were injured. The cars were badly wrecked. These are the first serious acts of violence since the strike of motormen on the Consolidated system began on November 10th. The strikers and their friends declare the strikers had nothing to do with the dynamite, but the company attributes it to the strikers.

A Providence (R. I.) dispatch states that an attachment for $125,000 has been levied on the property of William A. Walton and William N. Otis, as individuals, and of Henry W. Harvey and Samuel Otis, as copartners, on behalf of the United Traction and Electric company of New Jersey. The action is based on an advance of more than $100,000 by the traction company to purchase the Interstate Railroad company in Rhode Island and Massachusetts. The same persons are principals in a suit for $500,000, recently brought in New York, in which the traction company is defendant, the basis of which is an alleged breach of contract, in that the traction company did not complete the purchase of the Interstate railroad as agreed.

Charles H. Holmes, ex-president of the Fox River Electric Railway company and holder of $12,000 of the capital stock and interest coupons of the corporation, has brought action against Mitchell Joannes and Thomas Spence, as receivers of the company, and the Farmers' Loan and Trust company of New York. In his complaint he alleges that $117,000 par value bonds of the company were illegally issued, and charges that the receivers have illegally carried on the receivership, looking toward a reorganization of the company, instead of winding up the company's business. He asks that they be enjoined from expending further earnings of the company in improvements and that they be required to offer the road for sale at auction at once.

At a large public meeting held in Milwaukee on Monday evening the citizens adopted resolutions denouncing the proposition of the Milwaukee Electric Railway and Light company, offering the city annual payments of cash to reach the sum of $2,650,000 by 1924 as compensation for a monopoly of the street-railway business of the town until that date and the abandonment of the four-cent fare litigation. The Common Council was asked to enforce all ordinances applying to the company until it should reduce fares to four cents. In the meantime George H. Sager has applied for a franchise for a new company, the other promoters of which are not known. This is a four-cent fare proposition, and it is said that compressed-air operation is proposed.

Peoria wants a 50-year extension of its street-railway franchises, or rather the street-railway company wants it. President Barker has issued an open letter to the public regarding the application for an extension of the franchise, in which he explains and defends the Allen law and sets forth the arguments for the proposed change. He cites the fact that the stock of the company is owned almost entirely by Peorians, that it employs more labor than any other interest in Peoria, that it pays better wages than any other street-car company in any city of its size in the United States, and that the profits have been greatly cut down by the number of bicycles used. The company practically has a four-cent fare. The company agrees to build extensions involving an expenditure of $300,000 and make valuable concessions if its franchises are extended.

PUBLICATIONS.

The Western Electrical Supply company of St. Louis, Mo., is distributing, throughout the West and South, a pocket catalogue describing a complete line of Perkins-Gibbs switches. This book is intended principally for managers and construction houses.

"Enclosed Arc Lamps" is the title of the latest pamphlet issued from the General Electric press. It deals with the several types of enclosed arc lamps manufactured by the General Electric company for direct and alternating-current circuits, indoor and outdoor lamps, marine lamps, miniature lamps, power-circuit lamps, series-enclosed lamps and single-globe and double-globe lamps. Each type is well illustrated, and the object of its design and its advantages are set forth in simple language. It is written for the information of the general consumer as well as the electrician. Printing and illustrations are, as usual, excellent. The pamphlet will be sent to persons interested, on application to any of the sales offices of the General Electric company.

The Manhattan Electrical Supply company of New York is distributing its catalogue No. 19, which is described as one of the most complete publications of its kind ever issued. It should be of great value to the buyer. It contains 336 interesting pages, illustrating and describing the electrical apparatus manufactured by the company. Those interested in electrical supplies, telephones, etc., will be furnished a copy of the catalogue upon request.

An illustrated catalogue (No. 9) of the Marsh steam pumps has been prepared by the Battle Creek Steam Pump company for distribution to the trade. It is a complete and comprehensive pamphlet and describes in detail the features of special interest in the apparatus manufactured by this company. This catalogue is presented to the trade and steam users generally, as the result of a painstaking endeavor to display the company's regular lines in the most complete and intelligent manner possible. The lists and detail tables have been arranged with care, and in convenient form for reference and comparison. The various lines cover sizes and combinations to meet ordinary requirements, from which a suitable selection may be readily made. A convenient feature is an index.

"The Westinghouse Compound Engine" is the title of a comprehensive treatise issued by the Westinghouse Engine company, which is really a valuable addition to the literature on the subject. The illustrations comprise a view of the company's shops at East Pittsburg and pictures of the company's product. Several styles of engines and the principal parts are presented in detail. The pamphlet is devoted principally to a description of the single-acting compound engines, built in 11 sizes, which, with steam pressures of 100 to 150 pounds, cover a range of from 35 horse power to 740 horse power. For the larger sizes several excellent patterns of double-acting engines are briefly touched upon. The single-acting principle is departed from in the larger sizes for purely commercial reasons, and not because it is deemed less desirable from an engineering point.

TELEGRAPH.

Newport, R. I., is slowly recovering from the effects of the recent storm. Not until December 2d was there any telegraphic communication with the outside world after November 26th. The storm played great havoc.

NEW INCORPORATIONS.

The Crocker-Wheeler Electric company of Jersey City, N. J., with capital of $200, has been licensed in Illinois.

The Rockford Electric Lighting company has been incorporated by C. S. Mauk, F. M. Kirby, J. D. Wagers, A. G. Stewart, W. T. Palmer and D. C. Kinder to operate an electric-light plant at Rockford, with $6,000 capital stock.

The organization of the Crescent City Electric company has been perfected at New Orleans. The object of this company is to do a general lighting and power business throughout the city. The list of stockholders includes the names of H. R. Gogreve, Isidore Newman, William Adler, J. H. Murphy, Alfred Hiller, Paul Godchaux, S. Gumbell, William Oswald, Sidney White, J. H. DeGrange, I. Hechinger. Four-fifths of the capital stock is held by local capitalists and investors. The following-named officers have been chosen: Joseph H. DeGrange, who is president of the Canal and Claiborne Railroad company, president; Sidney H. March, director of the New Orleans and Carrollton Railroad company and member of the Dock Commission, secretary and treasurer; J. B. Craven, general manager; E. D. Saunders, attorney.

TECHNICAL SCHOOLS.

A new scholarship has just been conferred on the Scientific School of Harvard University by a gift of $10,000 from J. R. Jennings of the class of '77. Mr. Jennings is a mining engineer in the gold district of South Africa. The interest of this sum is to be given to a student of engineering. The first award has been made to J. S. Sanborn, '99.

ELECTRICAL SECURITIES.

The Clyde Gas and Electric company has bonded its entire plant for $25,000, and to secure the bonds a blanket mortgage for that amount has been executed in favor of the Trust and Deposit company of Syracuse.

The stockholders of the Chicago City Railway company, at the annual meeting to be held January 16th, will be asked to authorize the issue of $2,000,000 additional stock, increasing the total capital to $14,000,000. The amount to be put out actually is to be left to the option of the directors, and it is thought possible that the first issue will not be more than $1,000,000. The stock will probably be offered to shareholders of the company at par. It is believed that the proceeds will be used in financing the General Electric Railway company, which is

controlled by City Railway interests. The balance of new stock may be used for extensions. Stock transfer books will be closed for the annual meeting from January 6th to 16th. Three years ago the stock was increased from $10,000,000 to $12,000,000, the actual issues being made in July and October of 1896. The company has declared its regular quarterly dividend of three per cent., payable December 31st to stockholders of record December 15th. Transfer books will be closed from December 16th to 20th inclusive.

MISCELLANEOUS.

The gripmen employed on the North Side cable lines of Chicago have earned $1,285 as premiums for avoiding accidents, politeness and general good conduct during the year. The money is the gift of President Yerkes, and is divided into prizes of $70, $35 and $20.

The Canadian Brotherhood of Electrical Workers at Toronto has elected officers as follows: President, T. Eaton; vice-president, S. H. Kent; recording secretary, J. C. Long; financial secretary, F. Marson; treasurer, F. Hawkey; senior inspector, J. McNaulty; junior inspector, J. Devins; foreman, D. Northcote; trustees, G. Walker, J. Mongean and B. Hancock.

The employment of electricity for illuminating purposes is rapidly extending in Brussels. The lamps, as well as nearly all other electrical supplies in Brussels, are of German origin; Holland and England furnish part of the electrical wires employed. American lamps and other electrical goods are now on the Brussels market, and are conceded to be superior to those imported from Germany, France and England, and with proper effort the trade in this line could be greatly increased. Especially in copper wire, insulated wire, large cables and arc lamps is there an excellent opening, and American manufacturers in these lines should embrace the opportunity thus afforded them.

Among the papers read at the recent meeting of the British Association was one on the Thwaite and Cawley system of electric haulage, in which the author, A. H. Allen, states that in the new system all the difficulties hitherto met with in electric-canal haulage are avoided by making the motors entirely independent of the barges, and hauling the latter by means of ropes, exactly as with horses; in this way the loss of energy incurred with a screw propellor is almost entirely obviated. An aerial railway is provided, consisting of two steel rails of channel or Z-section, braced together at one side, so as to form a rigid girder. Not only will power be available for hauling barges, but it may also be used for working cranes, factory machinery, lock gates, etc., and for lighting warehouses and the canal itself, if desired. A useful application of power is two capstans at the locks, by means of which the barges can be handled with rapidity and ease when entering the locks or leaving them. As canal traffic with electrical haulage can be carried on both by night and by day, the conditions of working are especially favorable to a low cost of power, the generating and distributing plant being constantly in use with no idle period. Estimates have been prepared, showing the cost of haulage (1) by horses, (2) by electric locomotives at the same running speed as with horses, and (3) by electric locomotives at a higher speed (four miles per hour). For the purposes of comparison, the case of a level canal, 30 miles in length, has been taken, with an annual traffic of 100,000 tons per mile. The results show that without taking advantage of the higher speed possible with electric haulage the cost is 58.4 per cent., and the time 20 per cent. less than with horses, while when the speed is increased to four miles per hour, the cost is 47 per cent., and the time 50 per cent. less than with horses. Further, in the latter case, no allowance has been made for the reduction in the capital cost of barges (of which a smaller number would suffice), in the interest and depreciation on capital, and in the wages paid to bargemen, nor for the increase in the traffic and reduction of tolls which are expected surely to follow the increase in speed, the sale of electrical energy, the great reduction in cost of maintenance during prolonged frosts, etc.

TRADE NEWS.

The excellence of the Otto gas and gasoline engines was rewarded at the Omaha Exposition by a gold-medal award.

The Arnold Electric Power Station company of Chicago is closing a prosperous year, with prospects for a rapidly growing business. It has a number of important contracts on hand, including the installation of a complete central station of 2,000 kilowatts for the Imperial Electric Light, Heat and Power company of St. Louis; a complete lighting and power plant for the Garrett building, Chicago, 225 kilowatts; complete power, lighting and heating system for the Chicago and Great Western railway shops at Oelwein, Iowa, 300 kilowatts; Arnold system for the Chicago and Milwaukee electric railway at Highland Park, Ill., 250 kilowatts; Arnold system for the W. B. Conkey printing plant at Hammond, Ind., 100 kilowatts, and the Arnold system for the Chicago Dock company, Chicago, 250 kilowatts. The demand for the Arnold system indicates that it is rapidly growing in favor.

BUSINESS.

The Electric Appliance company reports that it is meeting with success with the '98 model Packard transformer, which is said to be more than fulfilling all the claims and guarantees that it has made. Examination of the interior construction of the transformer shows the substantial way in which it is built.

The Berlin Iron Bridge company of East Berlin, Conn., is erecting for the town of Whitehall, Washington County, N. Y., a riveted girder bridge, having a span of about 70 feet. The bridge is of latticed-girder type, with steel floor beams, and of a design to carry, besides ordinary traffic, the weight of a steel road roller.

The Western Electric company, Chicago, appreciating the advantage to customers of prompt shipment of orders, carries in Chicago a complete stock of S. K. C. lighting transformers in sizes from 10 to 600 lights, which are supplied with or without fuse boxes, as desired. The new style G, S. K. C. transformer, is said to be the most efficient transformer on the market. The iron core is guaranteed not to age with use. Bulletin No. 11,001 will be sent to all interested, upon application.

The city of Elkhorn has successfully started its electric plant, the power for which is furnished by a 125 horse power tandem-compound engine, which was built by the Ball Engine company, Erie, Pa. The Schoenhofen Brewing company, Chicago, has recently installed a 100 horse power Ball engine which is directly connected to a 60-kilowatt Western Electric generator. The Pine Bluff Cotton Oil company, Pine Bluff, Ark., has installed a 70 horse power engine, built by the Ball Engine company.

ILLUSTRATED ELECTRICAL PATENT RECORD.

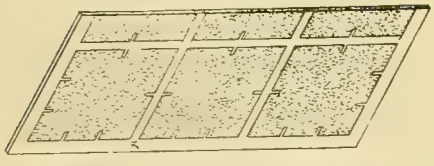
Issued November 29, 1898

614,819. Process of and Apparatus for Covering Wire with Asbestos. Ettore Albasini, Turin, Italy. Application filed May 28, 1898.

The process described of covering wire with fibrous asbestos consists in feeding the asbestos to the wire and compressing the asbestos about the wire by pressure gradually and progressively applied.

614,839. Method of Forming Electrical Connections. William B. Cleveland, Cleveland, Ohio. Application filed May 9, 1898.

The method of joining two members of copper to form an electrical connection consists of first casting one member upon the other, heating the two contiguous surfaces to a welding heat while free from atmospheric contact; second, supporting the casting in a die to prevent distortion; and, third, uniting the two members by application of pressure while they are at a welding temperature and free from contact of atmospheric air.



NO. 615,172.

614,875. Trolley for Electric Cars. Hosea W. Libbey, Boston, Mass. Application filed January 11, 1898.

A trolley head having two arms between which the main trolley wheel is mounted and a bracket on each side between which and one of the arms is mounted a small contact wheel or roller.

614,882. Junction Box. Thomas J. Murphy, New York, N. Y. Application filed April 22, 1895. Renewed December 31, 1897.

A box is provided for mounting and collecting electrical conductors, comprising an exterior wooden shell, a lining of a refractory, non-conducting material therefor, a cover provided with a similar lining, and a screw nipple or nipples extending through the exterior wooden shell against the lining, the lining being countersunk and receiving a washer, with a washer on the outside of the wooden shell.

614,914. Mechanism for Controlling Electric Circuits. George H. Whittingham, Baltimore, Md. Application filed April 5, 1898.

A movable device immediately controls the circuit; a screw imparts motion to the device; a pulley wheel carrying a lever which is adapted to engage the threads of the screw and thereby move it endwise in one direction, and means to place the lever in engagement with the screw.

614,930. Process of and Apparatus for Separating Metals from Ores by Electricity. George D. Burton, Boston, Mass. Original application filed January 25, 1897. Divided and this application filed April 11, 1898.

The process of treating ore consists in subjecting the whole mass of ore under treatment to pressure, and simultaneously to an electric current of high amperage and low voltage, and causing the pressure to follow the diminishing mass of ore during the operation.

614,946. Telephonic Microphone. William D. Gharky, Philadelphia, Pa. Application filed December 20, 1897.

A telephonic microphone having granular conducting material held between electrodes faced with material not readily oxidizable and backed by materials forming a thermopile is arranged so that the heat generated in the microphone is absorbed or conveyed away by the action of the current in the pile.

614,964. Dynamo-electric Machinery. Joseph S. Lewis and Felix J. Howitt, Manchester, England. Application filed March 12, 1898.

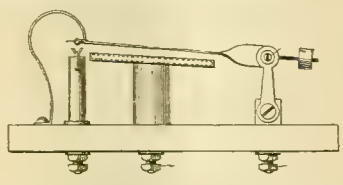
One claim relates to a multipolar machine with a field magnet comprising an outer magnet ring, inwardly projecting radial magnet cores secured to the ring, and annular plates of non-magnetic metal secured to the ring and to the cores.

614,982. Automatic Time Electric-circuit Switch. Frederic Richard, Boston, Mass. Application filed October 30, 1897.

The clock has a rotary dial furnished with adjustable pins adapted to engage the teeth of a toothed wheel and during such engagement to rotate such wheel, and a switch having the toothed wheel adapted for such engagement and rotation, and furnished with arms adapted by the rotation to be brought into contact with and close any or all of the electric circuits, and to be carried out of such contact and open any or all closed electric circuits.

614,995. Underground Conduit for Electrical Conductors. Charles H. Sewall, Chicago, Ill. Application filed March 2, 1898.

One feature is a body of material having a conduit inclosed therein, of an inclosing layer or sheath of insulating material completely surrounding the body of material on the top, bottom and sides and effectively insulating the same from the earth to prevent the access of extraneous currents to the inclosed body of material.



NO. 615,186.

615,057. Electromechanical Striking Mechanism. Clarence E. Beach and Herman W. Doughty, Binghamton, N. Y. Application filed September 8, 1896.

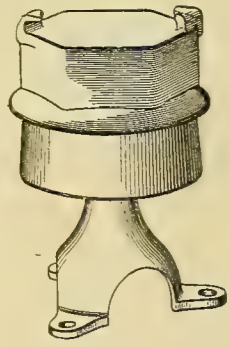
A revoluble part is provided with projections or indentations; an electro-magnetic controlling mechanism including magnets, an armature influenced thereby, and a part moving with the armature and constructed and arranged to engage with the projections or indentations and thereby arrest the motion of the revoluble part, and a lever operating or forming part of a striking mechanism, the lever being provided with a pawl or projection constructed and arranged to engage with the projections or indentations provided upon the revoluble part.

615,136. Electric Metal-heating Process. George D. Burton, Boston, Mass. Application filed August 24, 1893.

The art of heating metal bars consists in subjecting the parts to be heated while in contact with each other to the action of an electric arc sprung between them and an electrolytic bath.

615,172. Primary Battery. Henry K. Hess, Philadelphia, Pa. Application filed February 2, 1898.

This is a combined porous plate and electrode for a battery, consisting of a series of porous conducting carbon sections and a metallic conducting frame inclosing and retaining the sections and having a terminal connection.



NO. 29,741.

615,186. Electric Safety Device. John F. Kelly, Pittsfield, Mass. Application filed April 14, 1898.

There are a transformer, an electrostatically operated device having two relatively movable vanes insulated from each other, one being electrically connected to the secondary conductor, a local circuit in parallel with the translating device in the secondary circuit, means for closing the local circuit operated by the relative movement of the vanes, and a circuit-rupturing device, whose operation is due to the closing of the local circuit.

615,209. Electrical Hinge Contact. Channing Baxter, New York, N. Y. Application filed November 21, 1895. Renewed January 17, 1898.

In an electrical connection for hinges there is the combination with one flap of a hinge, of a spring contact located thereunder and having a portion thereof curved over the roll of the flap, and a contact located under the other flap and in rubbing engagement with the curved portion of the spring contact.

DESIGN.

29,741. Third-rail Insulator. Edward M. Hewlett, Schenectady, N. Y. Application filed November 7, 1898. Term of patent, 14 years.

Western Electrician.
EVERY SATURDAY.
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Niagara Power Development in Canada.

By Orrin E. Dunlap.

The present dispute between the government of the province of Ontario and the Canadian Niagara Power company in regard to the present status of the agreement existing between the power company and the commissioners of Queen Victoria Niagara Falls Free Park has attracted widespread attention from the fact that a similar agreement for the development of power is not known to exist, and the rather remarkable feature that the community receiving the sum of $25,000 a year should want to see the contract declared void, especially when this amount is the principal support of a park about which the entire Dominion does a great deal of boasting. Still another point that attracts attention to the case is the fact that the Canadian Niagara Power company is controlled by the Niagara Falls Power company, whose plant is on the New York side at Niagara, and a decision in favor of the Canadian Niagara Power company would place the entire development in the hands of one corporation.

In order to appreciate the merits of the points in controversy the preliminary steps leading to the present condition should be understood and considered. In the early part of 1896 the Canadian Niagara Power company made application to the park commissioners for an 18-months' extension of time, within which its initial works were to be constructed. While the commissioners favored the extension, the government did not see its way to sanction the recommendation, but it granted permission to the Canadian Niagara Power company to arrange with the Niagara Falls Park and River Railway company for utilizing the surplus power which the latter company had available for use in its power house in the park. The agreement was made between the power company and the railway company November 27, 1897, in accordance with the permission of the government, and the former installed in the station of the latter in Victoria Park two 500 horse power generators, each of 3,000 alternations and 2,200 volts, which is the same voltage at which power is generated in the central station of the Niagara Falls Power company on the New York side. These generators were made by the Westinghouse Electric and Manufacturing company, and are operated by the turbines of the Niagara Falls Park and River Railway company in its pit, the arrangement being such that either generator may be operated by either wheel. The generators, as will be seen by the illustration on this page (Fig. 1), are belt driven, and are very similar to the general type of belt-driven machines. From these generators current is supplied for the operation of the Canadian branch of the Carborundum company. The switchboard is shown in Fig. 2, page 338. The Niagara Falls Electric Light and Power company is a patron of the Canadian Niagara Power company, and the Carmelite Monastery is just preparing to use electric power, but the total amount of power sold by the Canadian Niagara Power company is small, corroborating the statement made by the commissioners of the park in these words:

It has always appeared to the commissioners improbable that a market could be found in the vicinity of the Falls, on the Canadian side, for large units of electric power at least for a year or

FIG 1. NIAGARA POWER DEVELOPMENT IN CANADA.—TEMPORARY PLANT OF CANADIAN NIAGARA POWER COMPANY.

two to come; but that the success of the enterprise must depend chiefly on the possibility of transmitting the energy over a wide area and distributing it to large and small consumers in cities and towns more or less remote from the Falls. The difficulties attending the economic transmission of electrical power, even to places as near to the Falls as Hamilton or Toronto, do not appear to be as yet fully overcome; while the machinery and appliances required to convey and deliver the energy to consumers will under any circumstances require the expenditure of vast sums of money. It will thus be quite apparent that only an organization having the command of unlimited capital, and the knowledge which alone comes from experience, could reasonably hope to obtain a successful future.

In commenting on the agreement between the power and railway companies and in approval of the integrity of the Canadian Niagara Power company the commissioners had said:

While it is a matter of regret to the commissioners that the carrying out of their undertaking should have been so long delayed

by the power company, and that the benefits to the locality which have been so eagerly looked forward to have thus been deferred, yet the commissioners are of opinion that the experience gained in the construction of the very extensive generating plant on the American side will be of very great advantage to the company in establishing its works in Canada on a sound basis from the beginning. This will especially hold true in respect to the transmission of electrical energy to distant points, the successful accomplishment of which will without doubt be one of the chief inducements to generate power on a large scale at this place. The knowledge now being gained by the actual working of the Niagara Falls, Buffalo and other long-distance transmission lines cannot but greatly add to the ultimate success, in a broad and comprehensive manner, of the Canadian Niagara Power company's plant in the park.

Thus fortified the power company anticipates a favorable decision in the litigation now pending. The point at issue is whether the holders of the charter for the establishment of a power plant on the Canadian side of Niagara Falls have forfeited their rights by their non-fulfillment of the agreement to have the plant installed by November 1, 1898. The disputants are the commissioners of Queen Victoria Niagara Falls Park and Albert D. Shaw of Watertown, N. Y., and F. L. Stetson and William B. Rankine of New York, who form the company for the transmission of electricity from the Falls. The defendants claim that they have been unable to complete the works by reason of the experimental character of the electrical development and the magnitude of the work in hand. The rentals paid to the commissioners up to the present time are said to be $150,000.

The hearing in the case was held in Toronto, Ont., on Monday, December 5th, before the High Court. The judges comprising the court were Sir William Meredith, C. J., and Justice Rose and Justice McMahon. The commissioners' claims were presented by Aemillius Irving, Q. C., and Z. A. Lash, Q. C., and the defendants' position was presented by Mr. Nesbitt and Monroe G. Grier. The questions put to the court were as follows:

1. Is the agreement void and of no effect by reason of the failure of the company to have proceeded so far with the works by November 1, 1898, as to have completed water connections for the development of 25,000 horse power, and to have ready for actual use, supply and transmission, 10,000 developed horse power, the company not having been hindered by unavoidable accident?

2. May the government or park commissioners, by reason of the non-generation of electricity by that date, declare the agreement, liberties and licenses, powers and authorities of the company to be forfeited?

3. If the whole agreement be not at an end, or if the same cannot be declared wholly at an end, are the government and commissioners, under the circumstances, relieved from the agreement not to grant or confer upon any other company or person the right to take or use the waters of Niagara river?

The question at issue seemed to depend upon the construction to be placed upon clauses 1, 10 and 13 of the agreement, which are as follows:

1. For the purpose of generating electricity and pneumatic power, to be transmitted to places beyond the park, the commissioners hereby grant to the company a license irrevocable save as hereinafter limited, to take water from the Niagara river, between the head of Cedar Island and the mainland south thereof, and lead such water by means of the natural channel between Cedar Island and the mainland and the further extension of the channel, to supply works to be erected and constructed by the company in buildings and power houses on the mainland within the park, on a location near the foot of the high bluff between the Carmelite monastery and the rear of the Table Rock house, which location shall occupy a tract of land of not more than 1,200 feet in length by not more than 100 feet in width, such location of buildings and power houses from time to time to be erected as shall be hereafter settled within the aforesaid limits by the commissioners.

10. The company undertakes to begin the works hereby licensed to be constructed by them on or before the first of May, 1897; and to have proceeded so far with the said works on or before the first of November, 1898, that they will have completed water connections for the development of 25,000 horse power, and have actually ready for use, supply and transmission 10,000 developed horse power by the last mentioned day.

13. If the company should at any time or times continuously neglect for the space of one year effectually to generate electricity or pneumatic power, as hereby agreed by the company, unless hindered by unavoidable accidents, the lieutenant-governor, in council, may then and from thenceforth declare this agreement, the liberties, licenses, powers and authorities thereby granted and every one of them, to be forfeited, and thenceforth the same shall cease and determine and be utterly void and of no effect whatever.

The argument of Mr. Irving for the commissioners consisted in showing a connection between the clauses quoted, especially 1, 10 and 13, and urging the fact that the company had forfeited its license because it had not complied with the agreement as contained in these portions of the agreement. Mr. Lash, also for the commissioners, argued that the whole matter turned upon the express purpose of the agreement, which was to generate electricity and pneumatic power for transmission to places beyond the park. He particularly emphasized the fact that the completion of the water connections meant that the company was to have head for 25,000 horse power, and that in regard to 10,000 horse power it was to make use of the water course, to have actually ready for transmission and use that amount of power. He insisted upon the contention that the agreement was a license and not a lease, and by the failure of the company to carry out the terms its exclusive right had elapsed. He further argued that it was clear that the development of the power was a material part of the object of the parties to the agreement, and that the failure of the one party to provide that released the other party to the contract.

Mr. Nesbitt, for the Canadian Niagara Power company, contended that the agreement provided for the exclusive use for a term of years of necessary property for cutting canals and erecting buildings, and if the defendant paid its rent and gave notice of renewal, the commissioners of themselves could not generate electricity or allow others to do so only within the limits mentioned in the agreement. The locations had been selected, the plans approved of and the work begun, but not completed. Under these conditions could the government declare the agreement annulled on November 1, 1898? Under the agreement, the first question was: Is there exclusive license or lease? Then, is there now power of revocation? Mr. Nesbitt pointed out that, in 1892, the agreement had been made for a 20-years term, and if, at the expiration of that period a renewal was desired it could be obtained, and so on, to 100 years. This was an exclusive right, and the privilege was not to be granted to any other company. If it was a license, coupled with certain rights, it was not revocable. He argued that Mr. Lash's contention, that the erection of buildings and readiness to transmit was the sole consideration, could not hold, in view of the fact that rent to the amount of $150,000 had been paid the government. The privilege to erect buildings, he said, was optional with the defendants. Until they discontinued paying rent they had the right to their lease until damage was done. The matter as to construction was not material. It was clear that certain clauses gave no right to forfeit, and that, therefore, the agreement was still in force. It was only in case the defendants did not comply with clause 13 that a forfeiture would be in the interest of the people. The case is still under advisement.

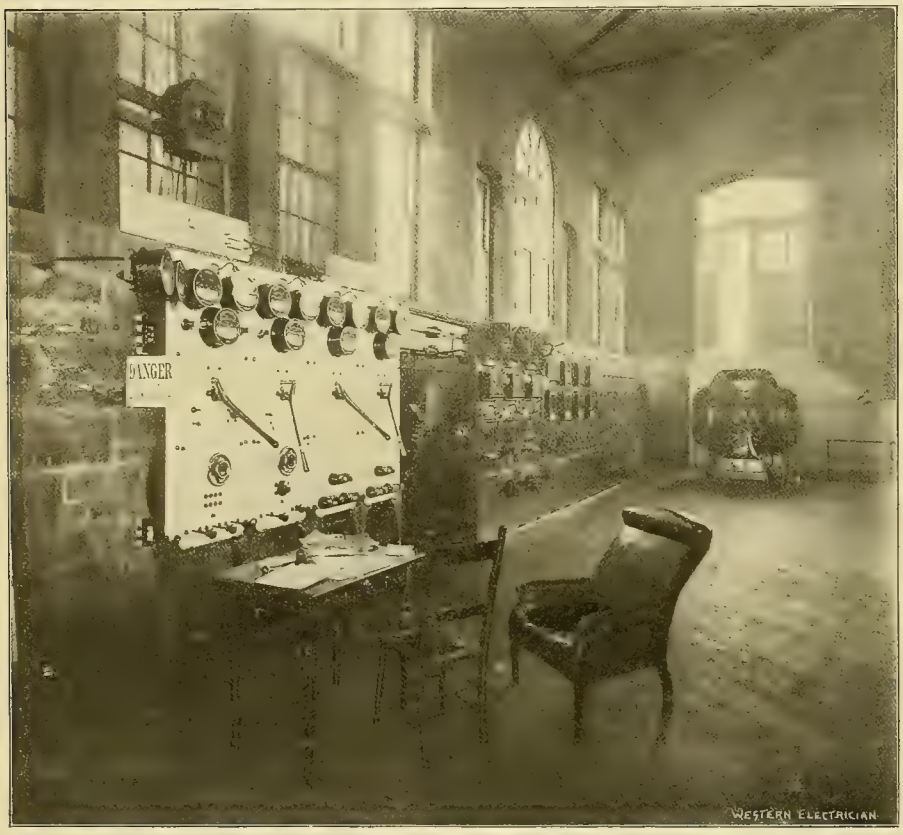

FIG 2 NIAGARA POWER DEVELOPMENT IN CANADA.—SWITCHBOARD IN TEMPORARY PLANT OF CANADIAN NIAGARA POWER COMPANY.

High-voltage Power Transmission.

By Chas. F. Scott.

Part IV.

Power-transmission Plants in Operation.

Beginning with the plant at San Bernardino and Pomona, which began operation in 1892, using 10,000 volts and transmitting 30 miles, a constantly increasing number of plants have been installed operating at 10,000 or 15,000 volts. In some cases there has been little or no trouble experienced with the transmission lines, while in other cases the experiences have been less satisfactory. The principal trouble seems to have been a poor grade or an insufficient size of porcelain insulator. In other cases the insulators, sometimes porcelain and sometimes glass, have given almost perfect satisfaction.

The superintendent of a power company which has been running 15 months with about 15,000 volts, reports that they "have had absolutely no trouble whatever of an electrical nature." Some insulators were broken because they had been used as targets by small boys or hunters, but only the outer petticoats were broken, and no short-circuits occurred, although in some cases insulators were in use for months with most of the outer petticoats chipped off. The distance of transmission is 12 miles. Porcelain insulators are used.

In another plant, which has been in operation about a year and a half, employing 15,000 volts for a distance of nearly 30 miles, there have been but three shut-downs on account of line difficulties. These were due to the breaking of insulators at a point where the line was spiraled. In one case the repair was made in half an hour, and in the other case a few minutes' interruption to the service was sufficient for repairs.

The line is regularly patroled, and if a defective insulator or pin is found, the generating station is notified by telephone and the line is shut down for a few moments at noon. In one case two poles were burned by a defect in the insulators on the top of each. The poles burned to the ground, leaving the line hanging clear, without anyone at either the generating station or sub-station being aware of the fact.

Troubles have arisen on some lines by the burning off of pins by the passage of sparks from the outer edge of the insulator to the pin. These sparks make small holes in the pin no larger than a needle point, but after continuous sparking for some time the pin becomes entirely charred. An iron pin suggested itself as a remedy, but additional strains and liability to breakdown are liable when a conductor is placed within the insulator. The burning off of pins has occurred where small porcelain insulators are porous and the outside glaze is imperfect, while the glaze on the inside is good. When the porcelain is filled with water the current readily passes through it to the lower rim of the insulator and then sparks across to the pin. In one place which has been running for about three years some 250 pins burned off. The early insulators have been replaced by larger and better ones and this defect has disappeared.

A 10,000-volt line which runs for a dozen miles or more within a few hundred yards of the Pacific coast has burned cross-arms on nearly every pole. The cross-arms near the ends of the line, which are away from the coast, are not burned. Usually the burning appears as a mere blackening of the cross-arm for a short space between the insulators, on one side of the arm. In some cases the charring is deeper, and appears on both sides. The side on which almost all of the burning occurs is the one toward which the winds come from the ocean, bearing the mist of salt water. The wire shows discoloration, and the iron braces for holding the cross-arms are in a few cases eaten through. Moreover, the cross-arms were green and full of sap when erected. The early porcelain insulators were porous, and have now been replaced, and the pins are of iron. The charring has ceased almost entirely since the new porcelains were put up.

It may be observed that in the plants which are herein referred to and in the experimental tests no mention has been made of insulators with cups containing oil for reducing the surface leakage. Insulators of this kind were used in the Frankfort-Lauffen experimental transmission line at 30,000 volts. Practically, however, the surface insulation is adequate without oil cups, and the principal duty of the insulator is to prevent the current passing over the surface and jumping to the pin or cross-arm, a matter with which the oil would have nothing to do.

Telephone lines are in use in a number of plants, placed on the poles which carry the transmission wires. The telephone lines are usually placed some distance below the transmission wires and are crossed at frequent intervals. The telephones in general work very satisfactorily.

There appears to be practically nothing in power transmission in Europe using high potentials outside of Switzerland. The installation in Paderno

in Switzerland is operating at 15,000 volts, the highest voltage which has been used in that country. The damp weather is one of the limiting factors. The insulators used are porcelain with a triple petticoat.

40,000 Volts in Commercial Service.

The highest voltage which is used for transmission is in the Provo plant of the Telluride Power Transmission company in Utah, which transmits power 35 miles to the Mercur mills at 40,000 volts. Raising transformers are three in number and are connected in the star form. Each transformer has a capacity of 250 kilowatts. The middle points of both the high-tension and low-tension circuits are grounded. In general design these transformers resemble the transformers used in the high tension

FIG. 16. HIGH-VOLTAGE POWER TRANSMISSION.—INSULATOR USED AT PROVO FOR 40,000 VOLTS.

tests at Telluride, the design and construction having been under the direction of the same man in both cases. The line extends from Provo, at an elevation of 4,500 feet, to Mercur, at 2,000 feet above Provo, and the line reaches an extreme height of about 10,000 feet above the sea level. Three miles of the line are strictly mountain construction. The lightning protection is afforded by choke-coils and Wurts non-arcing metal arresters. The insulators are of glass. The design was based on the tests at Telluride, and they were made especially for this plant. The form is shown in Fig. 16. The insulators are held on special pins of oak which are thoroughly paraffined. The lower part of the insulator is five inches above the cross-arm.

In dry weather there has been no difficulty whatever in operating. The insulators do their work as effectively as could be expected if the voltage were only a few thousand volts. When everything is dry, the line will operate without difficulty, even if some of the insulators are off and the wire rests upon the cross-arm. When it rains there is some-

FIG. 17. HIGH-VOLTAGE POWER TRANSMISSION.—INSULATOR USED BY COLORADO ELECTRIC POWER COMPANY FOR 20,000 VOLTS.

times trouble. It is indicated in the station by the ammeters giving quick swings, showing momentarily strong currents. Sometimes this is apparently a short-circuit and blows a fuse. In every case when there has been trouble on the line it has been found which located the trouble. It is certain that in most cases these have been previously broken by bullets, and in other cases it is probable that the insulators were likewise broken. It is believed, therefore, that had there been no intentional breakage of insulators there would have been no trouble upon the line since the plant began operating in February last. A few of the insulators near the station are not far from the overflow and are in a moisture equivalent to a rain all the time without doing any damage. Snow has often backed from the cross-arm up against the bottom of the insulator and around the first petticoat. It is usually found that the part of the insulator around and near the wire does not receive deposit [illegible] frost, but remains dry, the particles being repelled. At this plant, current for about 700 horse power is carried through three fuses of copper wire 0.01 inch in diameter. Iron wire is used [illegible] transmitting about 100 horse power [illegible] three miles.

This plant has been in operation in winter and in summer, "in thunder, lightning or in rain," the sole supply of power for the enormous De Lamar mines and mills at Mercur, and is a happy and fitting consummation of the high-tension tests described in the beginning of this paper.

Limitations of High-Voltage Transmission.

The important commercial question is: To what distance can power be transmitted? The relation between distance and voltage is well known. The same weight of copper can transmit with equal efficiency the same power to any distance, provided the voltage is increased directly as the distance is increased. The limiting commercial ratio between voltage and distance is easily found. If the distance be three miles per 1,000 volts and the loss 16 per cent., the cost of copper is about $20 per horse power. The interest on the latter investment is about $1 per year. A distance in miles equal to three times the number of thousand volts may therefore be covered without an excessive annual charge per horse power for copper. The limits to the voltage which are practicable depend principally upon the insulator and upon the loss between wires.

The Insulator.—The two fundamental requirements are dielectric strength sufficient to prevent puncture and a size and form which will prevent the passage of the current around the insulator. A given insulator will be adequate for a higher voltage where the atmosphere is comparatively pure and dry than it will be under other conditions. The rapid progress which has been made in the design and construction of insulators during the last few years will doubtless provide an insulator which will accommodate the highest voltages that can be used due to other limitations. The insulator, therefore, while remaining the critical point in a transmission system, will probably not determine the limit of practicable voltages.

Loss between Wires.—The loss between bare wires at high voltages seems to determine a positive limit, beyond which the voltage cannot be increased. This loss is subject to variation due to diameter of wire, distance between wires and wave form of the electromotive force, but the variations which may occur under favorable commercial conditions locate the point of increase of loss about 50,000 or 60,000 volts. Under favorable conditions this may be raised somewhat, but it is not probable that any material increase can be made.

Amount of Power.—The amount of power to be transmitted involves some interesting commercial limits. There are certain elements in a transmission which do not vary greatly with the amount of power transmitted. Thus, the charging current to the line will be practically the same whether the wire will transmit 1,000 horse power or 100 horse power. If the charging current happens to represent 300 horse power it would be insignificant in one case, but for the smaller output it would require generating apparatus several times that necessary for the actual power.

It is not mechanically practicable to use wires as small as would be sufficient, in so far as conductivity is concerned, for transmitting a small power. For example, a No. 7 copper wire, which is as small as is ordinarily used, if employed in a three-phase circuit 50 miles in length, will transmit over 1,000 kilowatts at 40,000 volts with 10 per cent. loss. If only a few hundred kilowatts were to be transmitted, the cost per kilowatt would be excessively high, and, on the other hand, a lower voltage could be used without undue loss. In some cases, indeed, where a high voltage is used for small power, as, for example, on a branch circuit, an iron telegraph wire would have ample conductivity. In other cases an aluminum wire could be used to advantage, as an aluminum wire of the same conductivity as a copper wire has only about half the weight, and possesses greater mechanical strength in comparison to its weight.

It may also be noted that high-voltage transformers cannot be economically built for small output, as the insulation spaces required are so large. The cross-section of the copper is often not more than 10 or 20 per cent. of the area of the opening in the iron. The cost per kilowatt increases very rapidly when the size of transformer falls under a few hundred kilowatts.

Cables and Conduits.—The overhead transmission line has been considered, and its limitations are the insulating strength of the insulator and the losses through the intervening medium. In a cable or a conduit the insulation must be provided continuously, instead of at points a hundred feet apart. Rubber-covered cables are made for 10,000 and 20,000 volts, but it is quite possible that it will not be commercially practicable to make cables for much higher voltages. The effect of continued electric stresses on the insulation of the cable, which is an unknown factor, may prove to be a very important one. A conduit composed of a pipe containing oil, in which the wires are separated by glass tubes, has been proposed. Many mechanical difficulties arise in constructions of this kind; the cost is high, and the action of continued high voltages on solids and liquid [illegible] able insulation on the [illegible] may enable higher [illegible] be used with a [illegible].

Liquid air, with its high [illegible] the low temperature and [illegible] tivity which it would give [illegible] may enable us to use [illegible].

Difficulties and Precautions.—[illegible] been referred to in this paper with perhaps undue familiarity. Familiarity with high voltages is not one which breeds contempt. A voltage which can produce sparks several inches in length, which can be felt through several feet of air, which causes hissing sounds, which produces luminosity, and which in a confined room generates strong odors of ozone, is one which creates profound respect. Dangers and difficulties accompany it, and the highest intelligence, [illegible] employed to avoid accident and insure success. While ordinary types of construction do not seem to reach their limitations until some 50,000 volts is reached; and pressures of this order have been and are in regular use, nevertheless they are not to be used indiscriminately or where they can be avoided. There are difficulties enough in handling 15,000 and 20,000 volts. As the pressure is raised the liabilities to trouble increase at an alarming rate. It is, however, a fact that these voltages have been and can be used, and also that no new or modified methods of transmission will be required before 50,000 or 60,000 volts can be employed for distances up to 150 or 200 miles.

APPENDIX A.

Instruments and Methods Used in Telluride Measurements.[1]

The Wattmeters.—At first all the measurements of power were made in the low-tension circuit. The attempts to measure the power delivered to the line by taking the difference in the readings of the wattmeter in the low-tension circuit of the transformers when the lines were on and when they were off proved worse than useless. This was due to the fact that throwing on the lines distorted the electromotive force wave impressed on the transformer. As a result, at low voltages, readings obtained in this way indicated a negative line loss, and it was only when the voltage was raised to such a point that the line loss was greater than the reduction in iron loss, due to the electromotive

FIG. 18 HIGH-VOLTAGE POWER TRANSMISSION.—OVERCOMING DISTORTION.

force distortion, that positive results could be obtained; such results were of course incorrect. In order to overcome this, it was determined to balance on the wattmeter the effects of the iron loss in one of the power transformers against that of the other in such a manner that both transformers would be subject to the same electromotive force distortion, and the iron loss would therefore at no time register anything on the wattmeter. The line loss could then be measured directly. This was accomplished, as is shown in Fig. 18.

Here the transformer which supplies the line is designated as the "power transformer," while that which is used in balancing the iron loss of the power transformer is called the "balancing transformer." As was stated in the description of the transformers, the power transformer has four of its low-tension coils in multiple for receiving power, while the fifth or middle low-tension coil is independently used in connection with the measuring instruments. This middle coil of each transformer is shown in the sketch, and it is through these coils that the balancing transformer receives its voltage. That is, one-third of the middle coil of the power transformer feeds one-third of the middle coil of the balancing transformer. With such an arrangement, the balancing transformer receives practically the same wave form as that impressed upon the balancing transformer, no matter what the amount of wave form distortion may be. A is the field coil of the wattmeter. It has two windings. Through one of them, the primary winding, passes the current to the power transformer; through the other, the secondary winding, passes the balancing current—the current to the balancing transformer. As these currents are in opposite directions in their respective windings, when adjusted to the proper values, their effects on the shunt coil of the wattmeter annul each other. It is evident that if A only were used, a balance for iron loss when the lines were off would not necessarily mean a balance when the lines were on, because the change in current due to putting the lines on would cause a change in the reactance electromotive force of the secondary of the wattmeter field coil, and consequently a change in the balancing current through this secondary. The air transformer B is therefore used; B is preferably, but not necessarily, exactly similar to the field coil A, and supplies an electromotive force in its secondary exactly equal to and in step with that of the secondary of A. These two secondaries are connected in series, so that their electromotive forces oppose, and through them both is sent the balancing current. The secondaries of A and B are not connected directly in series with the circuit connecting the middle coils of the power transformer and balancing transformer, but are included in this circuit through the medium of a series transformer C. C makes possible the adjustment of the balancing current to the value necessary for zero wattmeter reading when the lines are off, and it, or some equivalent device, is necessary because of the impossibility of securing two transformers with exactly the same iron loss. Indeed, in this particular case the ratio of the hysteresis to the Foucault current loss differed sufficiently in the two transformers to necessitate adding in shunt to one of them an ohmic resistance which made up for the lack of Foucault current loss in it. This method of reading power is, if properly carried out, a most admirable one, and has the advantage that the instruments to be handled are all in the low-tension circuit. The balance may be obtained without difficulty, and when once properly obtained holds through all ranges of voltages and distortions of wave form. Tests of this balance were made repeatedly with the lines off, by varying the impressed electromotive force through wide ranges and distorting the electromotive force wave, the distortion being produced by introducing in series with the power transformer

1. Extract from report of Mr. Mershon.

large amounts of both resistance and reactance In every case the balance was perfectly preserved. There is one drawback, though not a serious one, to the method as here employed. The power transformer, because of the load upon it, heats up faster than the balancing transformer, and the balance is in consequence impaired. The amount of unbalancing is, however, small, even for wide difference of temperature, and it can be easily corrected for by means of zero readings taken before and after a set of observations. This unbalancing, due to unequal heating, could be rendered negligible by placing the power transformer and the balancing transformer in the same tank of oil.

Although in this case the balancing transformer was of the same size as the power transformer, it may be much smaller, though both transformers should be worked at the same induction. Of course it is not necessary that the balancing transformer have a full set of windings. It need only have a coil suitable for receiving electromotive force impressed upon it.

The wattmeter actually used in this work (shown in Fig. 19) consists of a field coil so mounted that a Weston wattmeter can be slid in and out of it, and different ranges thus obtained. The scale originally on the wattmeter was replaced by one of equal parts. The wattmeter's own field coil is not used at all, the field being supplied wholly by the large external field bobbin. The voltage impressed upon the wattmeter shunt coil was at first obtained from the auto-transformer above mentioned, but later it was obtained directly from one-third of the middle coil of the power transformer by the use of an additional resistance or multiplier. The winding of the field bobbin consists of 27 turns of a

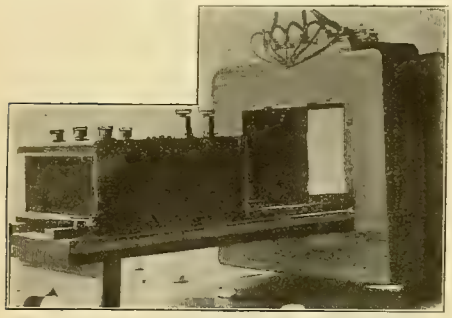

FIG. 19. HIGH VOLTAGE POWER TRANSMISSION.—WATTMETER WITH EXTERNAL COIL USED IN TESTS AT TELLURIDE.

cable composed of seven No. 8 double cotton-covered magnet wires which were twisted together after having been separately treated with P. & B. insulating compound.

The wires are brought out separately to terminals on the top of the bobbin, and can be used singly or in any desired series or multiple combination. They were, for this work, connected up into two sets, forming the primary and secondary of the wattmeter coil. The size of this field coil, necessitated by the size of the wattmeter box, gives it a large reactance, and as this has added to it the equal reactance of the air transformer, the reactance of the combination is considerable. This is objectionable because of the consequent distortion of the generator electromotive force wave, for though the results obtained under these conditions are accurate, they are in some cases the results of conditions differing widely from those which will ordinarily be met with in practice. The combined reactance of the field coil and the air transformer at a frequency of 60, when passing a current taken by a power transformer supplying the line, is 2.83. The current used in obtaining this figure probably differed somewhat from a sine wave. If the wattmeter were specially constructed with a view to this work, the movement being surrounded as closely as possible by the protecting case, the external field coil into which the movement projected could be made small enough to reduce the reactance to a negligible quality. In designing a wattmeter for this work, it should be borne in mind that it must measure under the condition of a very small power-factor.

In these notes the term "Weston wattmeter" is meant to include the field bobbin of the wattmeter and the air transformer used in connection with it.

After the above wattmeter had been in use for some time, another was obtained for use in the high-tension circuit. It is a Thomson inclined-coil instrument, whose field coil was rewound for this work. In connection with this wattmeter are two external resistances—the one with a resistance of 1,202,300 ohms, for use in series with the shunt circuit of the wattmeter; the other with a resistance of 3,495 ohms, being equal to that of the wattmeter shunt circuit and intended for use in shunt to the latter, in which case the wattmeter shunt coil receives only one-half of the current in the shunt circuit. When in use, the case

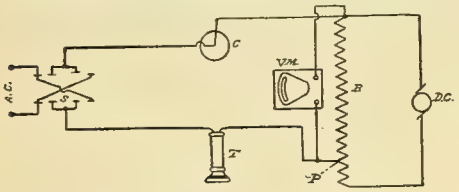

FIG. 20. HIGH-VOLTAGE POWER TRANSMISSION.—CONNECTIONS OF WAVE FORM APPARATUS.

of the wattmeter was connected to one of the wattmeter shunt terminals, so that the inside and case of the wattmeter were always at the same potential and the case formed a screen against any external electro-static effects. This wattmeter was of considerable value as furnishing a means of studying the effect of the distortions due to the Weston wattmeter, and also to the readings at low frequency, since, in the latter case, it was necessary to use both transformers as power transformers, which left nothing for use as a balancing transformer. In the notes this wattmeter is designated as Thomson wattmeter.

The Ammeters.—The ammeters used were two Thomson inclined-coil instruments. They had a capacity of one-half and two and one-half amperes respectively. They were put directly into the high-tension circuit, the cases being connected to one terminal of the instrument.

The Wave Form Apparatus.—The method of taking wave forms was that devised and published by the writer [Mr. Mershon] in 1891. It is an instantaneous potentiometer method, employing a telephone receiver to indicate a balance. The connections are those shown in Fig. 20.

A C is the source of the alternating electromotive force, whose wave form is to be plotted; S is a double-pole switch for reversing the alternating current terminals; C is the usual instantaneous contact device; T is a telephone receiver; V M is a D. C. voltmeter—in this case the Weston laboratory standard; R is a resistance along which the contact P can be moved. D C is a source of direct current—in this case a direct-current dynamo feeding the resistance R. The contact C being set at any desired point, the value of the electromotive force at the instant of contact is determined by moving P backward or forward until there is no sound in the telephone T. The reading of the direct-current voltmeter V M gives the desired value. The electromotive force A C was obtained from the same source as the electromotive force for the A. C. voltmeter, *i. e.*, from an auto-converter connected across one-third of the middle coil of the power transformer.

The Speed Indication.—The indication of proper speed, or rather frequency, was obtained from the vibration of a weighted steel wire hung in front of the poles of an alternating electromagnet energized by the machine supplying power. The wire always vibrated at the frequency for which the suspended weight was adjusted, and ceased to vibrate when there was any appreciable deviation from this frequency.

APPENDIX B.

Calculated Charging Current to two Parallel Wires. Length, One Mile; 10,000 Volts; Sine Wave.

The charging current to a single-phase line one mile long has been calculated from the formula for capacity between wires and on the assumption that the electromotive force is a sine wave. The results are given for several cases, and as the variations between the quantities given are not very great, intermediate values can be readily interpolated. The current varies directly as the length of line, the voltage and the frequency.

Size of wire—B & S.	No. 8	No. 4	No. 1.	No. 0000.	1" diam.
Distance between centers of wires.	Amperes at 60 cycles.				
12 inches.	.032	.035	.038	.0414	.053
24 inches.	.0281	.0309	.0328	.0362	.043
48 inches.	.0252	.0274	029	.0313	.0309
	Amperes at 25 cycles.				
12 inches.	.0133	.0146	.0158	.0172	.0221
24 inches.	.0118	.0129	0137	.0151	.0179
48 inches.	.0105	.0118	.0121	.0130	.0154

Surface-contact Electric Railways.

By Edward H. Johnson.

Part II.

The Switch.

Fig. 2 is a plan view of the switch box in its position in the roadbed, with the cover removed so as to show the internal structure thereof (the line 2 2 being parallel with the roadway). Below this in the same cut is a sectional view taken on the line 2 2. Fig. 3 is a transverse sectional view taken on the line 3 3, and Fig. 4 is a vertical sectional view taken through the body of the switch-enclosing box on the line 4 4 of Fig. 5, which is, in turn, a horizontal sectional view of the same switch-enclosing box taken upon the line 5 5 of Fig. 4.

Referring to the drawings in detail, and first to Figs. 2 and 3, B represents a cast-iron protecting box of rectangular form and provided with four legs B^2 B^2 B^2, adapted to sustain the box in position between two ordinary cross-ties T T. This box is cast in one piece with an upwardly extending inner flange B' running entirely around the interior of

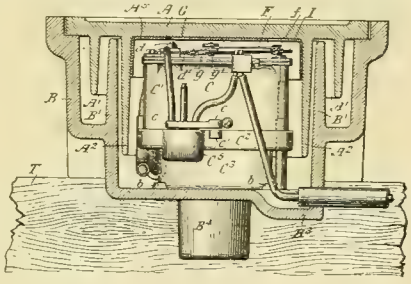

Fig. 3.

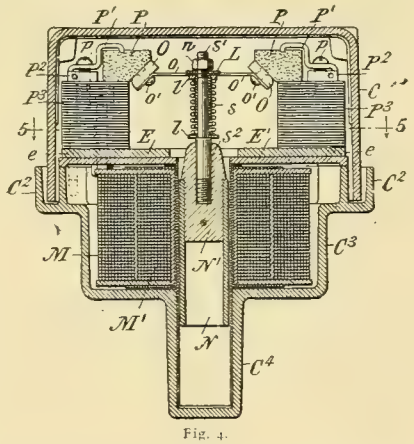

Fig. 4.

the box and adapted to form with the top or interior flange B^6 a deep-seated groove, which we may call a mud-groove. A represents the cover of the box, which is also of cast-iron, and is provided with two downwardly extending flanges A' A^2, the flange A' being adapted to extend a considerable distance into the mud groove, as will be seen on examination of Fig. 2.

The flange A^2 is somewhat longer than A', and extends to a point near the bottom of the box B, forming a sort of a dividing bell for the protection of the fuse block and terminals shown in the figures referred to.

The inner surface of the cover or lid A is lined with insulating material for the purpose of preventing any possibility of the continuance of an arc when the fuse, which is shown in Fig. 1, blows.

The switch-enclosing box proper (see Figs. 4 and 5) is composed of two cup-shaped parts C and C^1, the lower part C^2 being provided with an upper grooved extension C^5, and a lower cylindrical extension C^4, the arrangement being such that the lower edge of the upper portion C of the enclosing box will fit within the grooved portion C^5. The lower portion C^2 constitutes not only a part of the enclosing box, but is also adapted to act mechanically as a part of the magnetic circuit of the electromagnetic switch E', being a cast or wrought-iron plate with an opening in its center and held by small screws e e e to the upper face of the inner part of the grooved portion C^5.

The lower part C^3 of the enclosing box constitutes

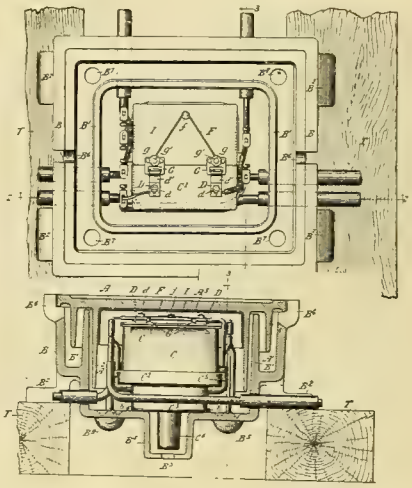

FIG. 2. SURFACE-CONTACT ELECTRIC RAILWAYS.

a chamber for the switch-operating magnet, which is of solenoid form, and is provided with two windings M and M'. N is a hollow solenoid core of soft iron secured to an insulating standard N', which, in turn, is secured by a rod S^2 to a series of yielding conducting arms O O O, having secured to their outer ends a series of good metallic conductors O O O, the whole arrangement being such that when the solenoid core is in its lower position the metal

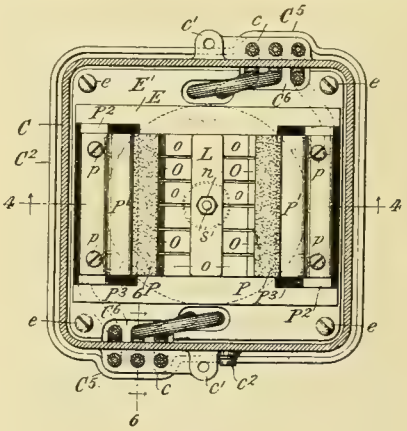

Fig 5.

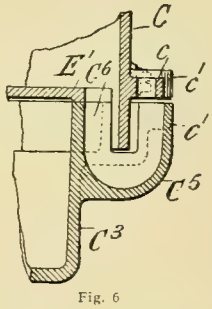

Fig. 6

SURFACE-CONTACT ELECTRIC RAILWAYS.

contacts O O will rest on the upper surface of the insulating plate E. P^3 are blocks of insulating material, preferably slate, and P^2 are blocks of conducting material secured to the same. P' are clamps for holding bevel-shaped blocks of carbon P P in position, the arrangement being such that when the solenoid core N is held in its upper position under the influence of an energizing current, the working current will pass from the conductor joining one of the carbon blocks P to and through the contacts O O O, arms O O and other contacts O O O, to the remaining carbon block P, and thence to the exposed sectional trolley conductor embedded in the roadbed in the manner well understood.

All of the parts of the switching mechanism are

properly assembled in the workshop and placed in position in the enclosing switch box C.

The cables leading to the switch boxes and to the ends of the magnet coils are bent downward in the side box C^5 as shown, and the cover C is placed thereon with its lower edge resting in the groove C^6, after which this groove is filled with paraffine or any preferred sealing material, thus assuring the fact that all of the operative parts of the switch will be protected at all times and ready for use when they arrive at their destination, where they may be placed in the outer box B^4 after the manner shown in Fig. 2, and the necessary connections made between the several conducting cables.

The Leak Circuit.

This invention was the direct result of the frequent recurrence of a "live" section, consequent upon the leakage of current from the high-potential button to the low-potential or switch button, resulting in the maintenance of the magnetic switch in a closed position and a consequent "live" section after the car had passed, instead of allowing it to open and clearing the section as it should.

By interposing the track rail, i. e., the negative conductor, between these two buttons, electric connection between them was made absolutely impossible except through the motor; hence a switch magnet could only be energized by the motor current, which is, of course, interrupted by the passing of the car, and never by the leakage current, which, being independent of the car, remains as a source of evil. The importance of this provision against accidental electrification of the street, as well as its efficacy as a remedy, is acquiesced in by everyone who has thus far considered the subject.

The diagram, Fig. 7, will fully illustrate the manner in which the leakage currents are effectively guarded against. Upon examination of this diagram it will be noted that the magnet-operating coils are contained in a circuit leading from the track rails to sectional rails placed outside of the same.

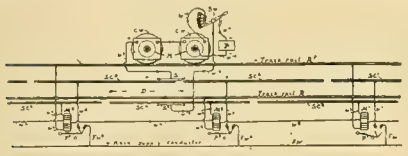

Fig. 7.

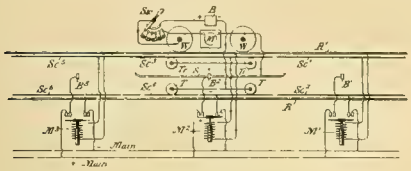

Fig. 10.

As the current which energizes the magnets travels in a direction from the sectional rails to the track rails, it follows that any leakage from the sectional service conductors SC′, SC^2, SC^5, etc., could never reach the outside sectional rails and cause a current to flow from said sectional rails to the track rails by way of the coils, all the leakage current necessarily being absorbed before it passes the negative track rails.

The Interconnecting Factor.

Experiments with the sectional-rail system developed the imperative necessity for a "time allowance" for the operation of the switches before demanding current of the successive contact buttons or rails as the car progressed; this demand for time allowance is, of course, increased as the speed is increased. It is a fact that without such provision a car running 10 or 12 miles per hour would "run away" from the current; that is to say, the car would pass over a button so quickly that its switch would not have time to act, and, consequently, the motor current not only failed, but destructive sparking at the switch contacts ensued. It is, of course, apparent that in the case of high-speed trunk-line roads this defect would be fatal. As to the efficiency of the means employed to give the requisite time allowance in a reliable and positive way, it needs only that the fact be stated that the current employed for actuating any given magnet is carried forward to and utilized in actuating the next succeeding one. If, therefore, the current employed is sufficient to energize the first, it must, of necessity, be sufficient for the next, thus insuring the operating simultaneously with the first and not at some indefinite period thereafter.

The connection diagram, Fig. 8, will fully illustrate the manner of interconnections between the operating-switch coils. For instance, the current will flow (see diagram) from sectional conductor SC^4 through wire W^4, through upper coil of magnet M^2, then by interconnecting wire W^4 around the lower coil of magnet M^3 to track rail.

Miscellaneous Factors

In the progress of development ensuing from the continuous chain of experiments conducted by us, many deficiencies not otherwise discoverable were made manifest. Among these were the following:

First—The fact that the surface leakage from the high-potential button to the track rails would suffice to keep the switch magnet energized if it were in the circuit between the main feeder and the high-potential button. This led to a complete reconsideration of the electrical circuits. To remedy the difficulty the switch magnet was finally placed in circuit between the motor and the track rails, instead of between the high-potential button and the motor, thus insuring the absolute isolation of the switch magnet after the passage of the car. This was a new provision against the hurtful effects of leakage, as will be seen from this statement of its specific purpose and function, and quite different and apart from that provided for in the leak circuit.

Second—The fact that the interconnecting feature as originally worked out for street-railway work would not operate with equal efficiency in both directions, and, therefore, though fairly satisfactory for street-car work, would not at all fulfill the requirements of trunk-line work; this led to its further consideration, with consequent result of a circuit arrangement affording equally effective operation in either direction.

Third—The fact that when a motor attained a speed which caused its counter electromotive force to approximate closely the direct electromotive force of the line, the current passing would be so diminished in volume as to be insufficient to keep the switch magnets closed, thus producing an uncertain action with consequently dangerous fluctuations; this led to a consideration of ways and means to insure a fixed minimum current through the switch magnet, independent of and indifferent to the quantity of current taken by the motor. The means finally introduced to effect this object proved upon trial to be positive and reliable in operation; without this provision, heavy traffic lines cannot be operated by a sectional-conductor system.

The diagram (Fig. 7) illustrating the leak circuit will also clearly show the "by-path" feature. Upon examination it will be noticed that the current for the motors flows from the positive main through

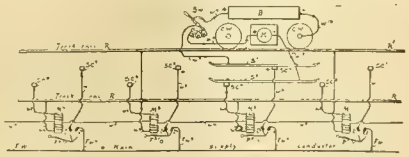

Fig. 8.

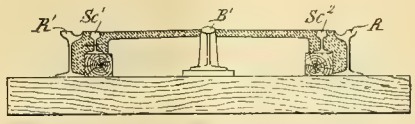

Fig. 11.

the switch contacts to a sectional conductor and contact shoe, through the motors and to the controller, where it divides itself—one part of the current flowing by way of the negative-contact shoe and sectional rail to and through the switch coils, and, finally, to the rails or the return conductor; the other part flowing through a storage battery of low voltage—charging the same—to the car wheels and to the return conductor. It will thus be apparent that should the current through the motors diminish to any great extent, the current through the battery connection W^{11} will reverse and the battery will supply the additional current needed to safely work the electromagnetic switches.

The Crossing Protector.

Among the many, and sometimes captious, criticisms which our work has met with during the period of its development was one condemnatory of the use of a storage battery of material electromotive force and current capacity and consequent cost and weight. We employed such a battery at the outset for the dual purpose of operating the magnetic switches and propelling the car over short distances; by the latter function obviating the necessity of electrically equipping crossings, switches, turn-outs and other situations otherwise involving not only expensive construction, but great liability to interruptions consequent upon the possible short-circuiting of the conductors at such places. Although we presently gave ear to this criticism as one involving a prejudice not readily combatted, we, nevertheless, adhere to the opinion that such combination of battery and direct supply will yet be found to be an exceptionally economical and practical system of street-car propulsion. However, having decided to concede the objection to be one deserving of our attention, we sought and found the means of dispensing with the battery, and, at the same time, overcoming the liability to interruptions in the event of short-circuits. The means discovered for accomplishing this may be expressed in the paradoxical statement that though a short-circuit may occur, and the safety fuse be blown, the current will yet flow in sufficient quantity to propel the car off the impaired section and permit its continuing progress without so much as an actual stoppage.

Such a provision is imperative in any surface-contact system, since in any such system it is impossible to so differentiate the planes in which the positive and negative conductors lie as to render accidental short-circuit improbable.

To illustrate this feature reference is made to Fig. 9, where S′ S represent the trolley shoes which are connected to the motor on board of the car (not shown), R R′ represent the tram rails of one line of rails and R R corresponding lines of rails of a crossing tramway, SC′, SC^2, etc., represent one line of sectional trolley conductors or contacts, and SC^6, SC^5, etc., represent the parallel line of sectional trolley conductors or contacts. BB represent two of the switch boxes, the circuit connections from the current feeder or main thereto and therefrom to the sectional trolley conductors being identically like those described in the previous diagrams.

F represents the fuse in the switch box, which is designed to "blow" for such current as may be deemed best, and X represents a resistance in a shunt or derived circuit about the binding-post to which the opposite ends of the fuses are connected, the arrangement being such that when any short-circuit occurs, between either of the trolley shoes, as S′, one of the sectional trolley conductors SC^5 and one of the crossing lines of rails, as R^2, the fuse will be blown, but the circuit between the circuit connections in the switch box and that particular sectional trolley conductor or contact will not wholly be ruptured, and the sectional trolley conductor when connected through the circuit connections in the switch box will still carry sufficient current to move the car over the crossing to the next sectional trolley conductor in advance.

Metallic Circuit System with Reversal of Leakage Currents.

Considerable prejudice against the use of the tracks and the earth as a "return" conductor having been developed through the inefficient methods employed in the early days of the overhead trolley, and great stress being put upon the fact that in the open-conduit system the track rails were not used as

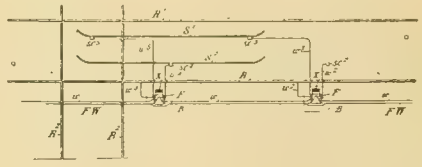

Fig. 9.

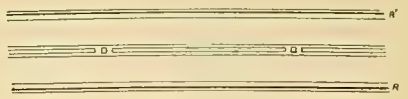

Fig. 12.

conductors, we thought it well to evolve, if possible, an alternative system in which the track rails and earth need not be employed as conductors. Our work in this direction is of an eminently practical character, not only retaining all of the good elements of the "track-return" system, but involving a new feature in the line of securing safety, viz., the reversal of direction of leakage currents from that taken by the motor current in passing through the negative switch, thus guaranteeing the "opening" of the switch and consequent discharge of the current from the street surface upon the passing of the car.

To illustrate the method of accomplishing this Figs. 10 and 11 are presented, where RR′ represent the tram-rails; SC′, SC^3, SC^5, etc., one line of sectional rails; SC^2, SC^4 and SC^6 another line of sectional rails, and B′, B^2, B^3, etc., contact points for delivering the positive current, the arrangement of conductors being clearly shown in Fig. 2, which represents a cross-section of the roadbed. When the switch M′, for instance, is open as shown, the positive main conductor and the negative main conductor are connected only to carbon contacts in the switch itself, there being no permanent connection betwen the sectional conductors or the tram-rails and the negative main.

It will also be noticed that the current for energizing the electromagnetic switches (see magnet M^2) flows from the track rails through the switch coils to one of the sectional conductors belonging to the row SC′, SC^3, SC^5, etc.

Any leakage from the contact point B^2 would have a tendency to flow from said point to sectional conductor SC^3, then through the switch coil in opposite directions, demagnetizing the same, to track rail and to the positive sectional conductor SC^4, which is the negative service conductor, from which it will be fully understood that any leakage currents, after the car has passed, have a tendency to quickly open the electromagnetic switch.

There has been a deal of superficial talk about the destruction of gas, water and other pipes by vagrant currents from the track rails when these are used as the return conductor. It is true that in the earlier equipments of the trolley roads too little attention was paid to securing a thoroughly good bonding of the rails and otherwise providing for giving them a sufficient conducting capacity, and

[*Continued on page 346.*]

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Telegraph operators are needed by the government for service in Cuba, but the compensation offered does not tempt men occupying positions with commercial companies. The War Department now has about 300 miles of telegraph lines under its control in Cuba, and it is expected that many hundreds of miles now in use by the Spanish authorities will be controlled by this government when formal possession of the island is taken. A large number of operators were enlisted in the Volunteer Signal Corps, but these men were in most cases released from regular positions with the promise that, at the end of the war, they should be restored to their places. The telegraph companies object to keeping these offers open now that peace has been declared, and a large number of telegraph operators in the Signal Corps have been mustered out for this reason. The government may find it necessary to fill their positions with civilians at regular rates, as good operators will not work for the pay of privates in the Signal Corps.

In "swearing off" its assessment in Toronto the Bell company's experts succeeded in establishing pretty clearly the fact that the exchange in that city was practically valueless, that the apparatus was antiquated, that the pole lines were worthless and that the entire equipment was only fit for the scrap-heap; but the company continues to keep up its charges. The only first-class thing about the Bell system in Toronto, it would seem, are the prices.

Provisions have been made for cable stations at Guam of the Ladrone islands and Kusaie of the Caroline islands, and it is probable that immediate steps will be taken by the present adminstration to establish a cable line to Manila. President McKinley has already expressed his views on the necessity of the cable to Hawaii and it is believed that he appreciates the importance of extending the line to our new possessions in the Orient.

This new turn in the affairs of the project for the establishment of an American cable is not at all pleasing to the advocates of the all-British line, and they are endeavoring to secure immediate action upon their plan by the Home office and the colonial governments, hoping thereby to offset the American agitation. It is recognized that only one cable can be maintained for some time, and that the first company to establish communication will of course enjoy a great advantage over later applicants for patronage. The cable would be extended to Japan and thus afford direct communication with the great markets that are now being opened up to American manufacturers.

An important consideration in the work of the commission which has been examining the international features of laws relating to patents and trademarks is the conditions created by the new territorial acquisitions of the United States. Hawaii has a patent law of its own, under which, up to last year, 138 patents had been issued. Under Spain's patent law, which has applied to all its colonies, there have been 19,000 patents issued since 1878 up to last year. The Spanish patents are subject to annual taxes to keep them alive, and probably not over one-quarter of them are now in force. The patents already granted, if now in force, it is asserted, ought to be continued for the periods for which they were issued, as it is contended that Congress cannot impair the validity of contracts. The issue is thus raised whether the United States will grant patents applying to the United States proper or to the whole country, including the new possessions; the latter is believed to be the more feasible course. As to Cuba, whose future status is not settled, the question is more puzzling, as American citizens who go there will want the same protection as at home. There doubtless will be an immense amount of machinery, implements, tools and manufactured articles taken in there, and protection for them will be sought.

The termination of a libel suit brought by Sir Joseph Savory against a London newspaper in favor of the defendant calls attention once more to the practice that obtains in England of floating companies through the use of names of prominent citizens and persons holding official positions. The plaintiff in this case was an alderman and a member of Parliament and he had occupied the office of lord mayor of London and other influential positions. He was charged with financing an electric-lighting company to his personal advantage while occupying a public office. Savory, while lord mayor, it was charged, arranged contracts and promoted electric companies for lighting the city, pocketing large sums on every deal. The pioneer company, which had a capital of £50,000, developed into the existing company, with a capital of £1 300,000 in £10 shares, now worth £30, and which could not be bought out under £3,000,000. Savory's brothers, sisters, aunts and cousins are said to have shared in the boodle. It is related that on assuming the mayoralty, in publicly answering a question whether he would avoid company promoting, he replied that he did not take office with any idea of personal aggrandizement, and he prayed that amid all the glittering pomp wherewith he was surrounded he might be enabled to walk lowly and humbly. "Holy Joe," as he was known, seems to have been a good deal of a humbug, even if all the accusations against him were not true.

Chicago has been engaged in consideration of the street-railway problem during the last two weeks, and the prospects are that the subject will occupy considerable attention for some time to come. The 50-year extension franchises asked for by the Chicago street-railway companies were first referred to a joint committee representing all parts of the city, but at the last meeting of the City Council the ordinances were recalled from that committee and sent to another committee. The object of this movement was to test the strength of the contending parties in the council, and, judging from the result, the companies stand little chance of securing the privileges they have asked for. It must be admitted that public sentiment, as manifested at public meetings and through delegations which have waited upon aldermen, is not favorable to the proposed measures. Mayor Harrison says he has secured pledges from enough aldermen to insure the defeat of the ordinances. He will veto any measure passed under the provisions of the Allen law, he says. The attitude of the street railways has aroused public indignation and has given considerable encouragement to the movement for municipal ownership of all plants of this description. The fact that all the franchises do not expire at once may prevent the adoption of this plan, but the companies will have only themselves to blame if such a scheme should ultimately give them serious trouble.

At the time the war revenue tax bill was passed the telegraph companies announced that senders of telegraph messages would be obliged to pay for the stamps required by law, and they were sustained by the ruling of the collector, although it was generally understood that it was the intention of Congress to levy the tax on the corporation instead of the people. There was a good deal of grumbling, but the people generally paid the tax. As usual, however, the emergency produced a man who was ready to take up the cudgels and fight the corporation. He was Howard Gray, a state senator of Missouri, and his action was based upon the refusal of the Western Union Telegraph company to transmit a message which he offered without first affixing the necessary stamp. The case was decided at Carthage, Mo., by Judge J. D. Perkins, who has had the matter under consideration for some time. The action was entitled Howard Gray against the Western Union Telegraph company, and involved the sum of 3 cents, which the plaintiff was compelled to pay on telegrams which he sent last July, shortly after the stamp act went into operation. When Senator Gray was first requested by defendant's representative to pay the tax, he declined to do so, but was eventually compelled to yield so that he might get his telegrams over defendant's wires. He immediately began suit for the return of money that he then expended in stamps. Judge Perkins, in his opinion overruling the defendant's demurrer, said that Congress, when it inserted a clause in the stamp act to the effect that telegrams should be taxed, intended that the telegraph companies should bear the burden. The Western Union company announced that it would appeal the case, and until final decision is reached the people will, of course, be compelled to pay the tax.

Recourse may be had to Congress to pass an amendment to the law which would make its language so plain that it could not be misinterpreted. Congressman Smith of Michigan announces that he will endeavor to have the ways and means committee take up this matter in the regular way, and if he is not successful he will try to have the matter brought directly before the house. He believes that there was not enough time allowed for debate on the war revenue measure, and he says that it was understood by nearly every member that it was the intention of Congress to make the telegraph companies pay this tax.

Engineers in the War.

The officers of the First Regiment of United States Volunteer Engineers gave a dinner, December 8th, at Sherry's, New York, in honor of their colonel, Eugene Griffin. Among those present as guests were:

Gen. W. S. Randolph, Col. A. S. Kimball, John Thompson, J. C. Bishop, Col. A. G. Mills, Gen. C. G. Sawtelle, Gen. Alex. Shaler, Lieut. W. M. Cruikshank, U. S. A., G. P. Mairs, C. A. Coffin.

Lieutenant-Colonel Hodges of the Engineers presided and Major Ira A. Shaler, Major L. L. Seaman and the other officers were present.

After coffee Lieutenant-Colonel Hodges called the attention of those present to the work done by Colonel Griffin in organizing the engineers, saying that he had taken 1,200 raw recruits, and in a short time had drilled them into a body of men equal to regulars. After other words of esteem and appreciation, Colonel Hodges presented Colonel Griffin a handsome silver loving cup.

In acknowledging the souvenir, Colonel Griffin made an interesting address in which he sketched the history of the formation of the engineers' regiment and the work in which it was engaged:

On the declaration of war last spring I felt, as every West Point graduate in civil life felt, that I was again called to active duty. It is easy to place one's services at the disposal of the government. It is not always easy for the government to find places for the 20,000 or more men whose services are so offered. I therefore determined to not only tender my services, but to suggest specifically the way in which I thought I could be made use of.

My position in civil life brings me into contact with engineers all over the country. This suggested at once a field of usefulness—the organization of the engineers for military service. I stated this to the secretary of war and suggested the organization of a brigade of engineers of 3,500 men. The secretary thought that 3,500 technical troops was too large a proportion. I quoted the war of rebellion records to show that in 1864-5 in Meade's Army of the Potomac over four per cent. of the total force were engineer troops; that in Thomas' Army of the Cumberland over five per cent. were engineers; that in Sherman's army in the march to the sea about 7½ per cent. of the troops were engineers, and, generally, that in all properly constituted armies the proportion of engineers was about five per cent. As we were then raising 125,000 volunteers the proportion would be 6,250 engineers, nearly double the number I suggested. The secretary acquiesced, and I wrote the bill authorizing the organization of a brigade of engineers, which I requested Senator Proctor to introduce in the Senate and Mr. Hull in the House. The second paragraph, in reference to the 10 regiments of immunes, was added by the military committee of the Senate, and this paragraph provoked some discussion, but ultimately the bill passed with the first paragraph as originally drafted, and with no opposition whatever expressed to the engineer brigade.

The First Regiment was authorized at once, and the Second and Third soon afterward. The selection of officers for the First Regiment was left to a board consisting of General Gillespie and myself, and I prepared the regulations under which the examinations were held. Officers were detailed for recruiting service, and every man was subjected to a careful examination by such officers before being accepted and passed on to the doctors for medical examination. As a matter of statistics, the recruiting officers rejected more than twice as many men as the doctors. We can, therefore, truly say that officers and men were all carefully selected.

The first detachment of recruits arrived at Peekskill on June 23d. Two days later Company A was mustered into the service. One month afterward, on July 25th, for the first time, the entire regiment attended dress parade in line of battalion masses. The last company formed had then had its uniforms and guns three days. On July 28th, the complete muster in of the regiment was effected. Only eight days after this, August 5th, we broke camp and started down the river for Porto Rico.

It should be recalled that we were armed, equipped and drilled as infantry, and it turned out that General Miles had intended to use us as infantry—at the outset at least. On reporting to General Miles at Ponce, he informed me that had we arrived two days earlier we would not have landed at Ponce, but that he was to have sent us around to the north side of the island to land at Aricibo and capture that city, then in the possession of the Spaniards. Aricibo is about 10 miles west of San Juan, with which it is connected by railroad, so that had we sailed four days earlier we should have had a most interesting experience. As it was we landed at Ponce, and the next three months we devoted to engineering work, outside of the military routine of guards, drills, etc.

One company was immediately detailed as the headquarters guard for Major-General Wilson, who was in immediate command after General Miles' departure, and Colonel Hodges, Major Sewell and myself were detailed as president and members of a military commission which was interesting as being the first military commission to sit on foreign soil since 1847.

The engineering work performed by the regiment consisted of:

A detailed topographical survey of the main highway from the sea, through Ponce to Aibonito.

A survey of the Aibonito pass, showing the locations of the Spanish batteries and intrenchments.

A detailed hydrographical survey of the harbors of Ponce and Guanica.

The rebuilding of the fine masonry bridges destroyed by the Spaniards on the military road which crosses the island.

The building of a dock and commissary storehouses.

The setting up of an ice plant and refrigerating plant for the general hospital at Ponce and the construction of buildings for this purpose.

The building of a concreted high-level reservoir for the hospital, and the completion of the water-supply system, including setting up the pumps, laying the pipes, etc.

The partial construction of Fort Capron on the heights overlooking the entrance to Guanica harbor, and the building of a road up the side of the mountain leading to the fort.

The laying out of the first national cemetery in Porto Rico, and many other minor works "too numerous to mention."

We sailed from Ponce homeward bound on November 18th, and reached New York on the 24th. We went to Porto Rico with 48 officers and 1,097 men. We returned with 47 officers and 857 men. We left one officer and 61 men in the hospitals at Ponce and Guanica; many men had previously been discharged or sent home on sick furlough, and many of the latter reported for duty upon our arrival.

The saddest feature of our experience has been the loss by death of one officer and 13 men, who gave their lives for their country as surely as did those who fell at San Juan hill and El Caney.

"Can storied urn or animated bust
Back to its mansion call the fleeting breath?
Can honor's voice provoke the silent dust,
Or flattery soothe the dull, cold ear of death?"

While Gray's ever-living words are sadly true, we shall always bear in affectionate memory the names of our comrades who sealed their love of country with that supreme sacrifice of life.

Such, in brief, is the history of this regiment. Had Toral held out at Santiago for a few days more, had Cervera delayed his dash for liberty, the story might have been very different. It is at least possible that under such changed conditions the war would even yet be in progress, and that the final act would be the siege of Havana. However necessary it may have been to prove the value of engineer troops under the ordinary conditions of modern warfare, every military man would have recognized the necessity and value of engineers in siege operations. The opportunity would have been offered us to introduce modern engineering methods and to change in many ways the traditional methods for the "attack of fortified places." S[illegible] pre-vented sortie , and electric motor [illegible] part in the trenches. Hospitals [illegible] by electricity and cooled by fan [illegible] battle-field would have been found [illegible] lights, and the surgeons would have [illegible] by the aid of the electric light.

The whole modern development of [illegible] since the last great war, that between the [illegible] in 1878.

In other branches of engineering [illegible] made. Modern high explosives are more powerful, easier and safer to handle, and therefore more [illegible] The development in the use of nickel steel, Harveyized plates, and other forms of defensive armor for battle ships would have been applied to modern sap rollers and [illegible] it is almost certain that the siege of Hava[illegible] the [illegible] tions now existing, would have gone down to history [illegible] marking a new era in the art of war, a change from the old conditions brought about mainly by the engineer. [illegible] Cervera did not wait. He made his sally, was [illegible], Toral surrendered and the war was over.

We have had our experience, which I hope will not be without value to each and all of us, and which I believe has taught some useful lessons. It is my deliberate judgment that engineers, including tradesmen, will make better soldiers than any other class of men, and by soldiers I mean all that the word implies—men trained in drill and marksmanship, able to care for themselves in the field, and to make long marches and to meet the enemy under all conditions, either offensively or defensively. The very nature of the training and daily lives of carpenters, blacksmiths, plumbers, lumbermen, railroad men, steam engineers, electricians, masons, etc., is a preparation for the life of the soldier. Moreover, we found that many of these men who had no intention of volunteering in the ordinary state regiments hastened to join an engineer regiment raised by the United States under a special act of Congress. This is another important fact which should not be forgotten.

I see in the papers that in the proposed increase of the army to 100,000 men, provision is made for two engineer regiments. An army corps consists of three divisions, each division three brigades, each brigade three regiments, making 27 regiments to each corps. One of these regiments should be composed of engineers, or in other words, we should have at least four regiments of engineers instead of two with an army of 100,000 men. If Congress can be brought to see this necessity it will be of benefit to our country in the future.

And now, comrades, as to the future. Unless we form some association to perpetuate the memory of this regiment, it is doubtful if we ever come together again as we are to-night. The thought is a sad one. I doubt if there is any comradeship so lasting, so close, so binding as the comradeship of the tented field. It is sad to see this broken up. The regiment has practically disbanded now, and a few days more will see all the officers scattered to their homes. You have all stood loyally and obediently by me as your superior officer; your services have been exceptionally able, conscientious and efficient. I have tried to do my duty by you and by the regiment. And now I wish you all good-by and Godspeed in whatever walks of civil life fate may lead your steps.

Following Colonel Griffin, C. G. Sawtelle responded to the toast, "The President." "The Army" was represented by General W. F. Randolph, who made an eloquent address on the work of the soldiers in the war, and complimented the volunteer engineers. General A. S. Webb spoke of "The Veterans of the War." "The Volunteers in the War" was responded to by Lieutenant W. M. Cruikshank, who was the officer who mustered in the engineers. C. A. Coffin spoke on "The Nation's Patriotic Women."

It is probable that, acting on Colonel Griffin's suggestion, there will be a permanent organization formed of the officers of the regiment and that the dinner will be repeated next year.

Electricity for Lighthouses.

It is announced at Marquette, Mich., that experiments will be conducted by the government at that point in the use of electricity in lighthouses. A submarine cable has been shipped to the local electric-light and power company, and it will be laid to the lighthouse on the extreme end of the breakwater in the lower harbor. The lantern in the lighthouse will be fitted with a concentrated-filament stereopticon incandescent light of 50 candle power, five times the candle power of the kerosene light which is now in use. But the increase in brilliancy is a secondary object. In the spring and fall gales waves frequently sweep the breakwater from end to end; and it is a matter of much peril for a man to traverse 3,000 feet of breakwater in order to light the lamp. With an electric light in the lantern the current can be turned on from the shore, and no matter how fierce the storm there need never be a fear but that the lamp will be found burning brightly. The first 1,000 feet of the breakwater is capped with a concrete superstructure which has a tunnel running through it. That far the cable will pass through the tunnel and be thoroughly imbedded in cement. For the remaining 2,000 feet, which is not capped by a superstructure, the cable will pass over the top of the breakwater, being held in its place by cleats. It is this part of the course which necessitates the use of a submarine cable, because heavy seas constantly break over it in storms.

Electric Works in Lourenço Marquez and Natal.

In his annual report to the State Department Consul Hollis of Lourenço Marquez, speaking of the prospects for improvement in trade in the colony, says that there is a disposition on the part of financiers of the Transvaal to invest money there. Already $250,000 has been spent by an electric company in the completion of an electric-light station, which is described by Mr. Hollis as the best equipped in South Africa. He continues:

"The buildings have all been built of hollow French brick, with iron beams and girders. Three large engines and six dynamos have been installed. All the boilers, machinery and fittings have been supplied by the Fives-Lilles company of Rhone, France. Upon the iron posts that have been planted along the streets I have, however, seen the marks of an English firm. This company has a concession for 50 years to supply electricity for light and power, and also for the sale of electric lamps and fittings. The company has already [illegible] municipal chamber to [illegible] candescent street lamps [illegible] $8,273.05.

"The government [illegible] Belgian syndicate a concession [illegible] and operate an electric street railway. On October 5th the Belgian consul, who represents the holders of the concession, submitted the plans for the railway to the municipal chamber, where they were approved and passed the same day. By the terms of the concession, work on the line must begin within nine months from October 5 [illegible] and in nine months more the line must be completed and open for traffic. The plans provide for about four miles of overhead street railway. In about a month an engineer will arrive from Belgium to make the preliminary surveys.

"Although Durban, Natal, is out of my consular jurisdiction, I do not think that it will be out of place for me to mention here that the Durban Town Council is about to appoint a commission of two engineers to investigate and report upon the electric street-railway systems of America and Europe, in order that they may intelligently decide upon the best system to be installed in Durban."

Both of these points are important cable stations on the eastern coast of South Africa. Lourenço Marquez (Delagoa Bay) is intermediate Durban (Natal) and Mozambique, the latter being 975 nautical miles north and the former 345 nautical miles south of Lourenço Marquez.

Electrical Machinery in Japan.

Japan has made great progress since 1853, when Commodore Perry opened up favorable trade relations on behalf of the United States. The commerce of the country has largely increased of late years, the total imports in 1897 amounting to $85,837,237, of which $13,515,268 came from the United States. For the same period the exports amounted to $81,567,487, of which the United States took $26,218,202. The growth and transformation of Japan's industries necessitate the extensive use of foreign machinery, supplies and material, and a large share of this trade is already in the hands of American manufacturers. During the first six months of 1898 the total value of machinery and engines (not including locomotives) imported from all countries amounted to $2,038,484.

The imports of dynamo-electric machinery into Japan have steadily and considerably increased, as will be seen by examining the following statistics:

	1895.	1896.	1897.
United States	$ 34,913	$139,757	$342,524
Great Britain	86,853	123,874	92,531
Germany	20,585	76,070	83,129
Belgium	....	532	12,424
Canada	....	....	9,048
France	12,103	449	5,572
Switzerland	1,052	4	....
Other countries	....	173	710
Total	$155,506	$340,867	$546,212

From these figures it will be seen that the United States has already gained a considerable lead in this trade. German manufacturers are very active and exert themselves to the utmost to increase their exports to the Far East; different German makers of electric machinery have established agencies in Japan, and everything is being done to secure a larger share of the increasing trade. There are tremendous possibilities in the line of electrical machinery and appliances in Japan. Several lines of electric roads are under consideration. Two powerful companies (one with a capital of $2,500,000) have been organized in Tokyo, and many new electric plants are projected.

There are no drawbacks to American trade in Japan and many reasons why the United States should enjoy decided advantages. One reason is that the Japanese people look upon America as a friendly power which first started them upon the road of modern progress. Another reason is the superiority of American goods and manufactures. Still another reason is that the United States is Japan's best customer so far as her exports go. With freights reasonably low and direct communication with Japanese ports (a fleet of new boats began a direct service between New York and Japan in the spring of 1898) our trade should largely expand.

Under the new treaty with Japan, which goes into effect on January 1, 1899, the duty on electrical machinery will be 10 per cent. ad valorem.

H. L. G.

Western Meetings of the American Institute of Electrical Engineers.

Mr. R. H. Pierce has been appointed local honorary secretary of the American Institute of Electrical Engineers at Chicago, succeeding Professor W. M. Stine, removed to Swarthmore, Pa. A movement is now on foot to revive the interest of the members living in and near Chicago in the western meetings of the Institute. These meetings were formerly held in the Armour Institute, but it is now proposed to arrange for a more central, downtown location, if the Chicago members evince sufficient interest in the project. Mr. Pierce is willing to give his time freely to re-establish the meetings and make them technically profitable and sociably enjoyable. If he secures the co-operation of the other local members, the first meeting for the season will probably be held within two weeks.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The linemen of the Mutual Telephone company at Des Moines, Ia., struck on account of a non-union man being employed. The company decided to let the disturbing element out, but the strikers then demanded that all who went out be re-employed. The management refused to accede to this, and sought new linemen in Chicago.

The Central Telephone company expects to have its new exchange at Manson, Ia., completed by January 1st.

The Henry County Telephone company is building a line from New London, Ia., to Lowell.

Selma, Ia., will soon have telephone connection with other towns in the county.

Negotiations are pending between the Spencer Telephone company and the Citizens' Telephone company at Spencer, Ia., to sell one plant or combine and operate but one system.

The new town of Titonka, Ia., now has telephone connection.

The Iowa Telephone company has completed an arrangement with the Western Electric Telephone company of Britt, Ia., to lease its toll lines and to make traffic agreements.

The new exchange at Fort Dodge, Ia., of the Fort Dodge Telephone company is rapidly approaching completion.

The Clearfield and Mount Ayr Telephone company is constructing a line in the vicinity of Afton, Iowa.

The Standard Telephone company's lines will soon enter Elkader, Ia.

Dr. G. W. Greaves has bought the interest of L. J. O'Mera in the Spencer Telephone company of Spencer, Ia., and is now the sole owner.

The Citizens' Telephone company's exchange at Mankato, Minn., will soon be ready for use.

A telephone exchange is proposed at Mondovi, Wis.

The Reddin faction has finally secured control of the Spokane and British Columbia Telephone company at Meyers Falls, Wash. It was done by securing the story over the exchange, and placing instruments in position and then cutting out the office underneath. The outwitted faction then left to begin new proceedings, leaving a man in charge. The company was behind in his salary, and the new faction soon induced him to accept payment and turn over possession, which was done. The old faction now demands a receiver.

The Dakota Central Telephone company has been granted admission to Mitchell, S. D., by the council committee, and the matter of a $25 revenue will be settled later.

The Inland Telephone and Telegraph company proposes to extend its wires in the spring to Waterville, Wenatchee and intermediate points, also to Titzville, Wash.

The Standard Telephone company will lay a cable on the bottom of the Mississippi River to enter La Crosse, Wis., from Minnesota.

The telephone line between Missoula, Mont., and Wallace, Idaho, will be completed about December 20th.

The Northwestern Telephone Exchange company is building a line between Rochester, Minn., and Red Wing, Minn.

A telephone line is to be built from West Union, Ia., to Prairie du Chien, Wis.

The Minnesota Central Telephone company has completed its lines to Pine City, Minn.

A new switchboard has been put in at Wheaton, Minn.

The Northwestern Telephone Exchange company has consolidated its local and long-distance offices at Le Roy, Minn.

J. B. Gilfillan objected to the Mississippi Valley Telephone company setting poles in front of his residence in Minneapolis, and, aided by neighbors, forcibly prevented the workmen from proceeding. He did not want his shade trees ruined.

The Chequamagon Telephone company promises to have its exchange at Ashland, Wis., in operation in 60 days.

Morgan Brooks of Minneapolis has sold his interest in the telephone system at Northfield, Minn., to his partner, C. E. Church.

The Northwestern Telephone Exchange company has removed its office in Worthington, Minn., to the office of the local company.

Fisher, Minn., now has long-distance telephone connection.

The Standard Telephone company joins the Rushford Telephone company's system at Hokah, Minn.

The Fergus Telephone company of Fergus Falls, Minn., proposes to construct a line to Wadena, Minn.

The Duluth Telephone company has made a lower rate for a two-party line for residences. It is now $36 per year, including a long-distance instrument.

A telephone line is proposed from Bemidji, Minn., to Brainerd, via Walker, Minn.

A telephone exchange may be established at Hokah, Minn.

S. S. Lichty of Waterloo, Ia., contemplates forming a company at Clarksville, Ia., and establishing an exchange there. It may be extended into a toll system.

A telephone line is contemplated from Ottumwa, Ia., to Albia, via Avery and Frederic. It will connect with the Albia line for Des Moines.

The Iowa Telephone company has recently made connection with 59 new stations in the state, making a total of 673 in all.

Independent Telephone Company for Boston.

[From the Boston Correspondent of the Western Electrician.]

A certificate of organization from the Massachusetts Telephone and Telegraph company has been filed at Boston. Zephaniah S. Holbrook of Cambridge was named as president and Frederick A. Spear of Lowell as treasurer. Capital stock was given as $10,000; par value of shares, $100. Back of the promoters are a number of influential citizens, and more capital is said to be promised when needed. This company has petitioned the Boston Board of Aldermen for the right to construct and maintain its system in the city of Boston. Theirs is an underground system, and they quote as their maximum rental of instruments for business and residence use only $6 monthly, against $15 charged by the Bell company. The petitioners ask for the privilege of laying conduits in a number of specified streets, and their application has been reported favorably to the board by the committee on public improvements. Considerable discussion was evoked by the project at the last meeting of the aldermen, and a public hearing has been given before the committee on public improvements. An important amendment was offered to the effect that the petition be granted only on condition that the company furnish service free to the city of Boston and bind itself not to sell out the franchise. This was referred to the committee with the original proposition. The city of Boston is now paying out about $30,000 annually for telephone tolls.

Proposed Arrangement Between Bell and Independent Companies.

A conference between the officers of the Iowa and Nebraska divisions of the American Bell Telephone company and two independent toll lines operating in Iowa, Minnesota and North Dakota was held in Des Moines recently for the purpose of arranging for the joint use of Bell and independent wires and joint rates. The following-named gentlemen attended the conference:

C. E. Yost of Omaha, president of the Bell system in Iowa and Nebraska, operating under the names of Iowa Telephone company and Nebraska Telephone company.

The vice-president of the Nebraska company, Mr. Morseman, from Omaha.

George E. McFarland of Des Moines, general superintendent of the Iowa Telephone company.

Senator A. B. Funk of Spirit Lake, president, and W. W. Prichard of Spirit Lake, manager, of the Iowa and Nebraska Telephone company, an independent line, which has headquarters at Spirit Lake and operates five exchanges and 500 miles of toll line in Iowa and Nebraska.

Thomas A. Way of Britt, manager of the Western Electric, an independent toll line of 1,200 miles of wire in Iowa, Minnesota and South Dakota.

The conference is the first of the kind ever entered into in Iowa by the Bell Telephone company. The first action of this kind was taken by the Bell company within the last few months, when it made joint arrangements with a Minnesota independent line. This change of policy has created the impression that the Bell company is starting to absorb the independent lines. "Does it mean absorption of the independent lines?" was asked of Senator Funk. "No," he replied; "it means a broadening policy on the part of the Bell management."

Damages Claimed by Lineman.

A damage suit against the Missouri and Kansas Telephone company has been filed at St. Joseph, Mo., by J. G. Parkinson and C. H. Harris, attorneys for Thomas Roberts, the plaintiff. The suit is for $11,000, and it is claimed that Roberts, who was employed by the company as a lineman last September, was ordered to climb to the top of a pole to do some work there. The cross-arm proved rotten, and while Roberts was standing upon it the support gave way and he was thrown to the ground, a distance of 20 feet. His left leg was broken at the ankle, and it is claimed that he was made a cripple for life.

One of the allegations in the petition is that the employes of the company under whose direction Roberts was working at the time knew the cross-arm was rotten, or could have known it by the exercise of due diligence.

Missouri Independent Telephone Companies Organize.

The Telephone exchange proprietors have organized the Missouri Independent Telephone association. Thirty exchanges were represented at the first meeting. J. A. Hudson of Columbia was chosen temporary chairman and E. W. Henry of Glasgow was made temporary secretary. A committee, consisting of the chairman and secretary and Theodore Gary of Macon, E. D. Graham of Mexico and D. F. Vincent of Slater, was oppointed to report a form of constitution and by-laws at the next meeting, to be held in St. Louis December 27th.

The Telephone in England.

An interesting article upon the present condition of the telephone in England, by Robert Donald, has attracted a good deal of discussion. It was provoked by the report of the investigating committee, the chief object of which, according to Mr. Donald, was to knock holes in the existing monopoly of the National Telephone company by isolated attacks from municipal corporations. It sought to counteract some of the wrongs which have been committed, and to avert greater dangers which threaten the state. The report recommends that, under certain conditions, municipalities should be empowered to establish competitive telephone services, but, it is remarked, the remedy is altogether inadequate, and comes too late, although it seems to be the only practical course open. Mr. Donald considers that the whole action of the Postoffice on telephones is a record of sins of omission and commission. At first it despised the telephone, and allowed private enterprise to have its own way. Caution, in the early days of experiment, was reasonable. When the telephone showed that it had come from America to stay, and looked like serious business, the Postoffice discovered that the telephone and the telegraph were one and the same thing. The courts held that the department had a monopoly in all such communications, but this discovery was not carried to its logical conclusion. The Postoffice did not itself take up the telephonic business, but favored a policy of free trade, and in 1880 began granting licenses with reckless liberality. After giving a good history of the subsequent movements which resulted in the National Telephone company obtaining practically a monopoly, Mr. Donald criticises the actions of Sir James Fergusson and others concerned. Coming to the question of the solution of the present difficulties, Mr. Donald says the recommendations of the select committee do not adequately meet the situation. They are palliatives which may only be partially successful in a limited number of towns. The case in favor of municipal telephones is complete, but the period during which the towns can keep the service is too short. It is true that the cost of installation has greatly decreased in recent years, and that the mechanical switchboard offers great advantages in small areas, although not yet a certainty; but the pressing demand is for cheapness and efficiency at once, not 10 years hence. Unless it were agreed, when licenses are issued to local authorities, that the Postoffice would, in 1911, acquire the municipal services at their then value, it is doubtful whether many towns would face the financial responsibilities. The Postoffice is not under any obligation to buy any system in 1911, and if it were to acquire municipal undertakings where they existed, it would have to buy up the company elsewhere on the same terms. Mr. Donald does not think that, with the difficulties which exist, there will be a rush of towns to Parliament next session for telephone powers. Some important centers of population, such as Liverpool and Nottingham, are apparently quite satisfied with the company. Glasgow and about 20 other towns which have advocated this new development in muncipal industry will presumably at once get to business. The corporations of these towns would have to face the formidable opposition of the telephone company, and, to judge from the past, the hostility of the Postoffice. The local authorities will not be able to compete on equal terms with the company. It is in possession, and entirely free from restrictions. It can charge what it likes, give preferences, or, in order to kill opposition, give a service for nothing, as one of the concerns it absorbed did in Plymouth to destroy the Postoffice service in that town. Again, were the corporations to provide an excellent service in their own areas, there is no danger that a subscriber, to obtain full facilities of communication, would have to join the company's system. The company has a powerful means of protection in the large areas which the Postoffice very considerately provided for it.

Mr. Donald insists that municipal telephones can only be successful if licenses are granted for the same period as the company's—20 years—a course which the committee admits is equitable, or if there is a certainty that the Postoffice will purchase the municipal plant in 1911. As far as the proposals go, it will be difficult to establish a municipal service, but easy to strangle it either by the company or the Postoffice. New competition will have to come chiefly from the Postoffice, which in future must act less as the agent of the National Telephone company and more as the guardian of public interests. After what has happened no one has much confidence in the Postoffice as a competitor. The select committee has none, and, in concluding its report, it says that "in thus recommending a Postoffice service [it] assumes that it will constitute a real and active competition, and that concessions to the company not required by the agreement will cease. Such a competition should, in its opinion, be carried on by a distinct and separate branch of the department, and in future be conducted under strictly businesslike conditions, and by a staff specially qualified for such a duty." Unless this change is made the new policy proposed cannot be successful.

Telephone Controversy in Washington.

[From the Washington correspondent of the Western Electrician.]

Criminal proceedings have been instituted, it is reported, and an indictment against Samuel M. Bryan, president of the Chesapeake and Potomac Telephone company, is now being prepared by the district attorney. It is expected that a true bill will be returned against him by the grand jury within a short time. The charge against Mr. Bryan is a misdemeanor, in collecting, receiving and charging for telephone service more than the rate fixed by law. While the act regulating the telephone rates in the District of Columbia, and fixing the maximum at $50 per year, does not provide for any penalty in case of violation, it is held by the government that such an offense is punishable under the general law for the commission of a misdemeanor, in violating a statute enacted by Congress. The matter was presented to the grand jury some weeks ago, but Mr. Bryan was absent from the city at the time, and, owing to press of business in the district attorney's office, the indictment was not drawn.

Telephones in Farming Sections.

Farmers throughout the Empire State appreciate the advantages of telephone service. Those of the town of Niles, N. Y., are extending their co-operative telephone lines into the adjoining towns of Owasco and Moravia, and it is only a question of time when the lines will extend into all the towns of the county, south of Auburn. Each farmer puts in his own instruments and puts up the poles and wires on his own land; the next farmer, if he wants the service, carries the wires along to his house, and passes them along to the next man. Should his neighbor not care to go to the trouble and expense of putting in the service, the wires are led to the highway and the poles are set at the side of the road by the farmer beyond who wishes the service. Nearly every farmer in the town of Niles has put in a telephone, and the service is found so useful that the idea is rapidly spreading. It is expected that within a few years more these private wires will extend into the city of Auburn. Then the townspeople and those living along the quiet highways can communicate with each other at leisure.

Cheaper Service for New York.

"Lower prices for telephone service. One thousand messages for $50," is the motto of the Merchants and Manufacturers' Board of Trade, which has established quarters at the Hoffman House. The association represents the best business circles in New York. William Russell, the assistant secretary of the association, said: "It was the intention of our association to have the purpose of their organization made a plank in the Republican platform. We sent a committee to Saratoga, and the members saw Senator Platt and Lieutenant-governor Woodruff. Senator Platt expressed himself as heartily in favor of the movement, but opposed its incorporation in the platform, because there was a question as to the advisability of making it a party measure—especially in view of the fact that the New York Telephone company annually subscribed $25,000 to the Republican organization. Still, Mr. Platt said he would do all he could to have the bill passed. Lieutenant-governor Woodruff spoke in a similar strain."

Telephone Controversy in Peoria, Ill.

A conference between M. J. Carney, general superintendent of the Central Union Telephone company, and Aaron S. Oakford, Charles D. Clark, Charles A. Jamison, Charles J. Off and Charles S. Jones, the committee appointed by the Western Merchants and Manufacturers' association in reference to the ordinance passed recently by the City Council granting a franchise to the telephone company, was held recently in Peoria. Mr. Carney, in his plea for the telephone company, made the usual claims of good service, etc., and called attention to voluntary reductions by the company. He said the company had earned nothing in Peoria in three years.

Telephony and Fire Protection.

[From the New York Tribune.]

The New York Fire Department is to have a telephone system as complete as its telegraph service in future. Every fire-alarm box will be a telephone station, and, instead of telegraph signals, for second and third fire alarms and ambulance calls, verbal messages to fire headquarters will suffice.

The change is the idea of Superintendent H. S. Blackwell, of the fire-alarm telegraph bureau of the department. He proposes to use the regular fire-alarm boxes and the present circuits for the new system. Each box will be altered to receive a telephone plug, and this is all that will be necessary so far as the boxes are concerned. Each chief in the department will carry in his wagon a case about three and a half inches by five inches, in which will be kept a receiver, a transmitter, an induction coil and a battery. When the chief reaches a fire in future, and finds that another signal is necessary, he will step to the box, open the inner door, insert the telephone plug, and the operator in fire headquarters will instantly be in direct telephonic communication with the man in command of the fire.

Telephony Abroad.

The attitude of the Council of Associated Stock Exchanges of England is represented in the following communication from Edward R[illegible] of Liverpool in the London Times upon the nationalization of telephones: "I think it is clear that the attitude adopted by the Postoffice toward the National Telephone company will have one effect—that is to say, the prohibition of that development on the part of the company which ought to meet the growing and imperative demands for its services. It is scarcely possible to expect a threatened company to embark fresh capital in order to meet such requirements. On the other hand, any attempt at a government local service in competition with the National company might easily result in a disastrous loss to the Postoffice. It is doubtful if the country will patiently submit to an inadequate service, and I think they would welcome a reasonable settlement with the National Telephone company. I cannot see why the matter should be incapable of arrangement upon terms both fair to the company and highly advantageous to the Postoffice. Assuming a government purchase based upon the average market prices, high and low, of the company's stock and shares during the last three years, taking into consideration the reduced interest charges and economy of working, and crediting the business with nothing beyond its normal progressive development, the result, so far as I can estimate it, would be that the surplus profits and royalties, if placed to a cumulative sinking fund, would at the expiry of the license (13 years hence) practically suffice to extinguish the purchase money. Surely this would satisfy the most prudent chancellor of the exchequer. The adoption by the government of the National company's system and its prompt development under the guidance and co-operation of the company's present administration offer, in my judgment, the only assurance of a widespread and perfect system of telephones for the present generation of business men."

Ries Telephone System.

The United States Telephone company, which was incorporated at Albany, December 5th, with a capital of $1,000,000, declares that it has acquired an entirely new system of telephony by means of which it will be able to furnish a better service than the present, and at the same time reduce the rates appreciably. Elias E. Ries, who is the inventor of the system, exhibited a working model of his system in New York last week, and claimed for it extreme simplicity of mechanism, cheapness of operation and manufacture, and effectiveness. Mr. Ries' system makes all calling and switching operations incident to conversation automatically by means of a simple mercurial contact, contained in a sealed chamber, located in the receiver of the telephone. The act of carrying the receiver to the ear rings up the central office, and a mere tilting of the receiver repeats the call. The hook-switch and ringing by a turn of the crank are done away with, the generator being located at the central office.

The corporation proposes to enter into the manufacture of systems of telephonic apparatus and to introduce the system by means of existing companies or new sub-companies. Mr. Ries' associates are Israel Steinhart, H. A. J. Wilkens, Martin Lowenstein and Henry J. Furlong.

Extensions and Improvements.

The British Columbia Telephone company will extend its line to Rossland, B. C., and establish an office there.

The Central Union Telephone company is rebuilding its plant at Rock Island, Ill., and introducing many improvements.

W. B. Ogden is before the City Council of Hoquaim, Wash., with a request for a franchise to establish a telephone exchange.

The Pennsylvania Electric company is at work on an order for 2,000 telephones for the Independent Telephone company of Lancaster County, Pa.

The Conway telephone line opened for business at Denison, Texas, November 23d, connecting Denison with Colbert, Silo, Durant, Emet, Tishomingo, Linn, Cumberland, Ravia, Marysville, Oakland, Raysville, McMillan, Wilson, Regan, Belton, Connerville, Pontotoc, Ardmore, Provence and Durwood.

The Pennsylvania Electric company of Marietta, Pa., was granted an award at the Omaha Transmississippi and International Exposition for the excellence of its telephone apparatus. The company has received the bronze medal and certificate of award, properly executed by the officers of the exposition company, which was awarded it.

The East Tennessee Telephone company has completed another circuit from Chattanooga to Knoxville. The company has also completed an exchange at Rockwood which opens with a large number of subscribers. This company now has three circuits to Knoxville. Two are along the Southern, and the third one along the Cincinnati Southern. In the spring the matter of eastern connection will be taken up and Atlanta connected with Chattanooga. "The telephone business is good," said Manager C. C. Duncan, last week. "We have had a net increase in the number of telephones in use in Chattanooga during the last year of 75. Chattanooga now has excellent long-distance facilities."

The Chesapeake and Potomac Telephone company has submitted to the city commissioners of Baltimore plans and specifications for the proposed extension of conduits. Representatives of the company and the city are in consultation on the subject. City Solicitor Semmes will prepare an ordinance to repeal the ordinance passed in 1886, giving the company the right to lay conduits in the city streets.

An extraordinary long-distance telephone test has been made at Little Rock, Ark., by Charles J. Glidden, president of the Southwestern Telegraph and Telephone company. Mr. Glidden held a distinct and clear conversation over the wire with Frederick A. Farrar of the firm of Poor & Greenough, Boston. The distance from Little Rock is 1,900 miles. Satisfactory tests were also made with Memphis, Chicago, Minneapolis, Dallas and Galveston.

The Kinloch Telephone company of St. Louis is gradually opening its exchange and connecting up subscribers. It has issued catalogues containing the names of about 2,000 subscribers. New catalogues are issued every week as additional subscribers are connected and the operators at the exchange become familiar with their work. The full number of telephone subscribers will be connected up in January, it is believed, and the exchange will then be in readiness.

The Western Electrical Supply company of St. Louis reports some very flattering returns in its telephone department, having recently sold complete exchanges in which its improved outfits were selected. The company has recently made numerous changes in this department and now claims to have as complete an outfit for modern exchanges as can be secured anywhere. The company calls particular attention to the express switchboard, which it claims is of the most modern type and very rapid in operation. It has also made numerous improvements in its Twentieth century and long-distance telephones, which are fully described in its new No. 18 catalogue, which is now ready for distribution. A copy of this pamphlet may be had upon application.

The Bell interests gained the controversy in Windsor, Ont. Under the new terms made with the company the city is to receive $500 annually and three free telephones. The rate for business offices, for local service, is fixed at $25 and the residence rate is $20, with Detroit service $15 extra. No extra charge is made for Detroit service for residences if the subscriber has Detroit connection at his business office. The agreement between the company and the city was signed by the mayor and clerk, and will be sent to Montreal to receive the approval of the telephone company. The franchise will date from June 15th last, when the company's former franchise expired, and the city will receive revenue from that date. The new rates took effect December 1st.

Governor Leedy, at Topeka, Kan., took part in a sort of national gossiping party last month, the headquarters of which were in the Commercial Club rooms at Kansas City. The occasion was the opening of the long-distance telephone from Kansas City and adjoining points to the East, and the Kansas City Commercial Club took occasion to call up all the notables they could reach and tell them about it. It was the intention to have a little gubernatorial gossip by connecting Governor Leedy with Governor Stephens of Missouri or some eastern executive, but two governors could not be got "on the string" at the same time. Connections were made with nearly all the eastern cities, and conversations held with several notables. At one time the White House was rung up and a conversation was held with the president's private secretary.

A committee representing the projectors of the proposed Co-operative Telephone company, consisting of George Riddle, Charles F. Galloway, William M. Payne, E. J. Pocock and M. L. Boyd, held a conference with the Board of Public Works of Columbus, Ohio, lately and asked the co-operation of the city administration in a movement for better and cheaper telephone service. The promoters propose to form a co-operative company to furnish telephone service to the citizens of Columbus below the present price of the Central Union. It had been estimated that the charges could be reduced to $36 a year. It was proposed to issue single shares, at say $36 each, each share representing one telephone, and no one person to be allowed to own more than one share. If, after the system should be in operation, it should be found that service could be given for less than $36 a year, the subscriber to the share of stock would get the benefit of a reduction of rental. The projectors were aware that the city could not control franchises, but the projectors wanted to pave the way for the acquirement of the plant by the city, at actual cost, at any time when the city should see fit to take it. The discussion took a rather wide range, including the relative prices of telephone service in the different cities of Ohio, and it was asserted that independent telephone companies were now in operation in 65 cities of the state to the satisfaction of their subscribers and great reduction in rentals.

Surface-contact Electric Railways.

[*Continued from page 341.*]

that, under such conditions, the electric current, seeking a pathway of lower resistance, would traverse any contiguous conducting body, thereby effecting more or less injury thereto through electrolytic action. When, however, this fact had once been made clearly manifest, additional attention was given to consolidating the rails by electric binding and otherwise, so as to give ample conducting capacity, with the natural result of so minimizing the vagrant currents as to well-nigh eliminate their destructive effect; in fact, notwithstanding much that has been said of late upon this subject, it is an open question whether the evil actually exists where intelligent work has been done in laying the track rails. If, however, it is held to be desirable to have an absolute guarantee against such action it is not at all necessary to abandon the simpler system of a single-wire conductor and track return and go to the complex two-conductor system. It is quite within the electrical engineer's ability to completely eradicate the defect by the simple means of employing asphaltum about the base and sides of the rails when they are laid; the insulation thus afforded, though not of high quality, would yet be ample to care for the comparatively slight tendency of the current to leave the track rails and seek other conductive bodies.

The importance of preserving a smooth and unobstructed street surface is far greater than that of safeguarding against a wholly problematical injury to gas or water mains, but there is, I repeat, absolutely no necessity of incurring either objectionable condition. Moreover the cost of so insulating the rails as to eliminate all leakage would be trifling in comparison with the laying of a system of double conductors.

Conclusion.

Having thus encountered and overcome every possible obstacle, whether raised by virtue of our own foresight, the criticism of others or the operation of the system upon experimental trial, we determined to put in, in practical operation upon a prominent New York street, and prove the complete efficacy of all its factors "in the eye and under the nose" of railway managers, municipal authority and the public at large. This was done and the demonstration, continuing over a period of eight months, proved conclusively that the system was reliable, economical and safe in all weathers and under all conditions of street surface. The sole criticism—one evolved, by the way, more from a predetermined intent to condemn than upon an honest judgment—was as to the physical obstruction of the streets by the two rows of buttons then employed in the system as the contact points. This criticism had a colorable ground under the conditions with which the work was environed.

First—The work was done in the winter season, with frost on the ground.

Second—The buttons were founded upon the same unyielding base as the track rails in order to keep their top surface in the same plane as the track rails. The pavement in turn was founded upon sand. The inevitable consequence was a settling of the pavement on the disappearance of frost, and a consequent considerable protruding of the buttons above the street surface, thus creating an objectionable obstruction to horse and wagon traffic.

The simple remedy for this fault was, of course, to give to the street pavement as complete and satisfactory foundation as was had by the buttons themselves, and as is done in cable and open-conduit work; but the critics of the system were not seeking light; they were after damnatory points, and though compelled to admit the satisfactory operation of the system, its safety, etc., and even that the buttons would not be objectionable upon the street of an European city, where pavements were better laid, they adhered to the conclusion that upon our streets the buttons would be condemned by municipal authority.

While still combatting this view and insisting upon the entire feasibility of so consolidating the buttons and the pavement as to maintain their surfaces always in the same plane, we have, nevertheless, in pursuance of our policy of confronting every hostile and prejudiced criticism with a complete antidote, sought and found a way and means of dispensing with the buttons altogether, substituting therefor simply a single third rail, sectionally divided and so laid as to insure its perpetual identity with the track rails themselves.

In accomplishing this without abandonment of any of the valuable factors incidental to the button system, Mr. Lundell has evolved an invention which may yet prove to be the key to the whole problem, particularly in view of the fact that it not only simplifies the system, but materially reduces its cost. Fig. 12 is a sketch showing the appearance of a street in which our system is installed.

An important quality of the surface-contact system is its extreme flexibility; unlike the open-conduit system, all its operative parts are on the surface. It is, therefore, entirely feasible to pass at full speed from the surface contacts to an overhead trolley, and vice versa. There is no "plow" or other incumbrance to remove.

A storage battery may be likewise combined with the system to operate the cars over unequipped portions of a line. The battery need not be removed from the car for charging, as it is being constantly charged while passing over the equipped sections.

[Mr. Johnson closed his address by reading opinions prepared by Lord Kelvin and the late Dr. John Hopkinson, both of which were highly complimentary.]

Practical Points in Street-railway Engineering.[1]

By W. A. Harding.

It was suggested to me that rather than present to you a paper full of data, etc., I should call your attention to the points of interest and problems that are met with in practical street-railway work, so that you could start a discussion and give to each other your personal experiences.

First, I must call your attention to the fact that it is impossible to make any arbitrary laws for the conduct and management of street-railway property, owing to altering conditions under various circumstances; financial conditions, condition of travel, nature of ground, locality, speed and climatic conditions all require different managements and present different problems to solve.

A road running through a very thickly populated district with good roads has the cost of operation at a minimum and can afford to spend a few thousand dollars to raise low joints, put in plenty of feed wires and keep the cars well painted. But take a road running out far into the suburbs and sparsely settled districts; to put up feed wire, keep up voltage as it ought to be and to raise low joints would bankrupt the company, and as for painting cars, it is out of the question. Many a country road runs through marshy land, making low joints the rule. The mud and water may be thrown all over the cars, and if this is of an alkaline nature, you can imagine what would become of paint. Motors that under ordinary conditions are called water-tight will here fill with water unless extreme measures are taken to provide against it.

The choosing of a suitable car and equipment formerly consisted of buying car, truck and motor without reference to their suitability to each other, and then the car or truck would have to be rebuilt to fit. I remember a company that bought long 36-foot combination cars, closed in the center and with seats at each open end, having two massive four-wheel center-pivot trucks, and two 15 horse power motors. Grades were from three to 12 per cent. It was only a short time before the motors were completely roasted. The company then went to the expense of cutting the body down to two-thirds size, taking one truck and lengthening out to seven feet and putting in two 15 horse power motors. The equipment now ran satisfactorily, but, owing to poor construction of the car body, it would "hog-back" in a very short time, necessitating constant renewals of subsills, etc.

Now, what cars shall we use? Take a supposed case. For winter the public demands a five-minute schedule, and the average load is from 25 to 35 people; during rush hours, say 100 people per load. We do not want to haul around a large car empty half the day, so we will put on a 22-foot car, as large as is advisable for a single truck with two motors, and having large and roomy platforms; if in a cold climate, preferably vestibuled. Now, if the cars should be a little crowded, the platform would always accommodate a few. When the rush comes on one or two trailers could be added for a few hours. If quickness and dispatch in unloading are not the predominating features, or too many transient passengers, a large double-truck trailer car is, in my mind, much the better. They are easier for motormen to handle than two single-truck cars, easier to ride, easier on the track joints, require one conductor in place of two and make mush faster time.

During the summer the same rule applies, except that when the climate allows open 10-bench cars should replace the closed ones. If travel warrants it, there is still a better field for larger cars (which have side entrances) making less units.

Now in the suburban districts sometimes the smaller cars will not accommodate your passengers and yet you cannot afford to put on more cars. Here you can use your large cars to advantage; in fact, you can sum up the whole problem as follows: Use the largest seating-capacity cars that a satisfactory schedule will warrant. For suburban travel where speed is the main point, double trucks having four motors can be run faster than single trucks, with less wear and tear on equipment, track and passengers.

A word as to trucks. They should be built with the side bar in one piece having no bolts or rivets, except where the cross-braces for hanging brakes are placed. Brake shoes should not be hung on links, but in such a way that they cannot kick and will take up their own wear. An average wheel base of eight feet is proper for single trucks when under a 22-foot closed body or 10-seat open-bench car. Springs should be graduated to allow the car to ride easily without undue oscillation. The same rule applies to trucks for double equipment, only the wheel base should be as short as the motor truck will allow, also permitting the car to oscillate sideways.

The motors should be carefully chosen for the work to be done. A powerful motor if put under a light car hauling trailer will slip the wheels on the track and the car will not make sufficient speed; but if the car body, trucks and motor are of sufficient weight to get the best traction, the train will now make faster time. The bearings of the armature should be large and fed from below with wick feed from oil, with box above to hold wool waste with additional oil in place of the usual plan of dope. Such bearings should be built outside of the motor frame and also protected by large circular disks to prevent the oil from working into the motor.

The commutator should be made of good drop-forged copper bars, the diameter to be as large as possible. In G. E. 800 we use a bar 1½ inches high. By using soft amber mica between the bars, the commutator wears smooth and keeps it polished. The number of slots in the armature should be kept as low as possible, it being cheaper to make repairs when four to six coils can be put into one slot; also coils should be machine wound, a thing not possible with all our armatures now.

A motor, if carefully kept clean, the brushes properly treated and changed each night and not abused unnecessarily by the crew, will last without rewinding for from four to five years, and even longer. With proper attention to brushes, commutators of the modern type should wear not more than one-eighth inch per year.

It will take too long to go into track and line construction in this paper, but I will just touch on a few points.

How are we to get the voltage raised at a distant point of the line where it is required for only a few weeks in a year. The cost to install a storage battery or booster, or to put up more wire, is all out of proportion to the returns. Take one of your dynamos with a capacity equal to the load demanded at this particular point. Change your two switches to double throw. When thrown up all connections are for running as a dynamo on the switchboard in the usual way. By throwing blades down the + of machine is thrown onto an auxiliary bus-bar and the — onto the positive main at the switchboard, making this particular dynamo in series with the station. The equalizing switch is left open; the field wires are not altered. The dynamo is now run at whatever voltage you need, may be 200 or 300. The feeder that goes out to the point of the line where you wish voltage raised is now thrown onto this booster, as we must now call it. Again, if the feeders are properly adjusted, a switch and fuse can be put in between the circuit-breakers of several sections and a whole district raised in voltage, if only for a few hours during rush time. As the station usually holds a reserve unit, there is no additional outlay or expense needed. In case of a breakdown or disabled generating unit, the boosting would be discontinued until such time as repairs were made.

Accumulator traction has greatly improved. Batteries are more durable and it certainly has a future of its own. Cars running without interference from outward sources or with each other cannot be overlooked, but I think they are not generally suitable, for the expense of changing batteries on all the outlying districts of a large system would be enormous. A few of the disadvantages are increased weight of car, an expensive roadbed, depreciation of the batteries and difficulty of recharging under all conditions.

I was asked the comparative cost of operating different systems of street railway, and will quote from the report of H. H. Vreeland, president of the Metropolitan, New York, the following statement:

Expense of operating horse cars....17.87 cents per mile.
Expense of operating cable cars....16.42 cents per mile.
Expense of operating electric cars...10.23 cents per mile.

In each case conditions were equally favorable for the system used.

1. Read before the Chicago Electrical association, December 2, 1898.

COMMUNICATION.

Electrical Measurements.

To the Editor of the Western Electrician:

In Mr. Hale's paper on "Electrical Measurements," printed in your issue of November 26th, a statement is made concerning which I should like further information. He says, if I understand him correctly, that when a voltmeter is connected to the terminals of a battery of high internal resistance the readings of the meter do not give the total difference of potential between those terminals. I can readily understand that it will not register the total difference of potential generated by the cells, but why should it not give the difference between the terminals? It is this difference between the terminals or available voltage that we usually wish to measure. Is not, then, the voltmeter to be relied upon to give this quantity? A READER.

Chicago, December 8, 1898.

In answer to "A Reader's" inquiry, I would say that the difference of potential at the terminals of a battery on open circuit is equal to the total electromotive force of that battery. This is true for all internal resistances short of infinity. When the battery is closed through an external resistance, the "available" voltage at the terminals will depend upon the relation of that resistance to the internal resistance of the battery.

We use a voltmeter to measure potentials as they exist, and when the measuring instrument first lowers the voltage and then registers the diminished pressure, instead of the true voltage, can it be con-

sidered a "voltmeter" in the correct usage of the term?

In the case described in my paper, where a high-resistance battery is under test, the discrepancy between the true and indicated voltages is not of much account, but there are instances in which this discrepancy might be of considerable importance. As an illustration of this, I will give the results of a test recently made to ascertain the exact difference of potential between the terminals of an incandescent lamp that was burning in series with a number of others on a constant-potential circuit. The voltmeters employed were laboratory standard instruments, and were identical in their readings when corrected to an accumulator of exactly two volts' difference of potential.

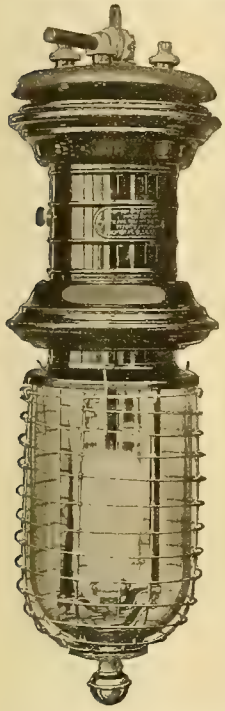
Voltmeter scale.	Voltmeter res.	Indicated p. d.
0—3	342.98 ohms.	1.51 volts.
0—15	1,689.50 ohms.	1.85 volts.
0—150	17,149.70 ohms.	1.95 volts.

It is obvious that the high-resistance voltmeter came nearest to indicating the voltage actually existing at the terminals of the lamp. The others produced a fall of potential between the terminals, and then indicated the lowered potential.

The foregoing is only one of numerous cases in which care must be exercised in the use of all voltmeters that operate by the passage of a current through their coils. W. B. HALE.

Marine Enclosed Arc Lamp.

Adequate electric illumination of wharves, docks, warehouses, drydocks, shipyards, with their adjacent ironworking shops, and the holds of vessels, while loading or discharging, demands a type of lamp somewhat different from that used for street or store lighting. It must be strong, compact and durable to withstand the hard usage which such service will naturally give it; it should give a large volume of clear, white light, which will not dazzle the eyes of the workmen nor throw heavy shadows in already obscure corners; it should require little attention, and be so simple that it can be attended by an average lamp trimmer; lastly, it should require trimming only at long intervals. The lamp designed to meet these requirements and manufactured by the General Electric company, is compact, simple and reliable, and is protected from injury or the effects of the weather by a stout metal casing. It is only necessary to renew the upper or long carbon once in 100 to 150 hours, the lower carbon, after the first run, being the unburnt remainder of the upper carbon. With open arc lamps, it was necessary to renew the carbons daily. The outer globe, shown as of clear glass in the illustration, is cylindrical in shape, of thick glass and protected from injury by a heavy wire guard. The globe can be lowered by a half-turn of the thumbscrew at the side, and when pushed back in position is automatically and securely locked. The lamp is only 28 inches long. It can be carried from place to place, if necessary, and hung by the metal ring at the top of any convenient hook, or may be permanently fixed in place like an ordinary arc lamp. The lamp can be used on a 110-volt circuit and can be adjusted for four, 4.5 or five amperes, the latter being the standard.



MARINE ENCLOSED ARC LAMP.

Tile Bolt and Lock.

The tile bolt and lock illustrated is intended for use in fireproof buildings where the columns and girders are covered with tiling. This device consists of two pieces of metal with partially corrugated outside surfaces, which, when placed together, form a shape similar to a cone. The opening in the upper end when the pieces of metal are put together is countersunk, allowing the bolthead to which the insulators or other devices are to be fastened to fit snugly between the two pieces of metal. These two pieces of metal, together with the bolt, are inserted in a hole in the tiling. A small concave washer slips over the bolt and a nut is then screwed up close to the ends of the small pieces of metal; as it is gradually tightened it draws the bolthead down into the space between the two pieces of metal until it makes them bind tightly to the sides of the hole, the end deepest in the hole binding tightest; this leaves the shank of the bolt free for attaching any device that may be desired.

The illustration, Fig. 1, shows an insulator and a ceiling button or rosette attached to the bolt. Fig. 2 shows how the tile bolt and lock may be used for attaching ornamental brackets to the side of a wall. It will be particularly noted that partitions in the tiling or tile or marble slabs resting against flat surfaces do not interfere with the use of the tile bolt and lock, as in the case of toggle bolts, there being no need of an open space, as is required in the use of toggle bolts. These valuable specialties are introduced to the trade by the Western Electric company of Chicago.

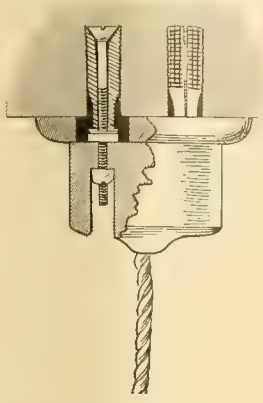


Fig. 1.

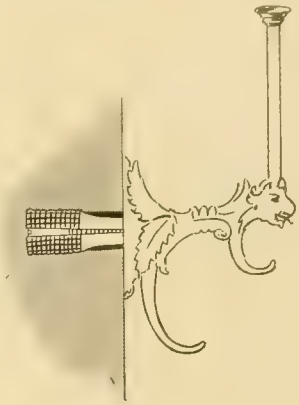


Fig. 2.

TILE BOLT AND LOCK.

Zeco Arc Lamp.

The accompanying cuts illustrate the Zeco enclosed arc lamp now being handled by the Central Electric company of Chicago. The lamp structure is substantial and is designed to insure perfection and permanency of operation. All of the exposed parts are nickel-plated. The coils are wound with a special fire and waterproof wire which also withstands the action of acid and sulphur fumes, thus particularly adapting it for use in train sheds, mills, etc. The clutch, Fig. 1, is composed of knurled rollers, V-shaped, each on an arbor self-adjustable to any size carbon or to any irregularity, and is positive and sure in action. No carbon rod is employed, the current being conducted directly to the carbon by eight brush contacts of bronze.

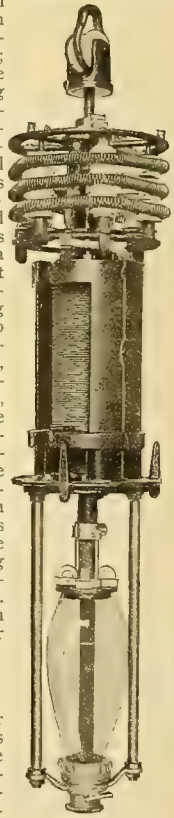


Fig. 1.

Fig. 2

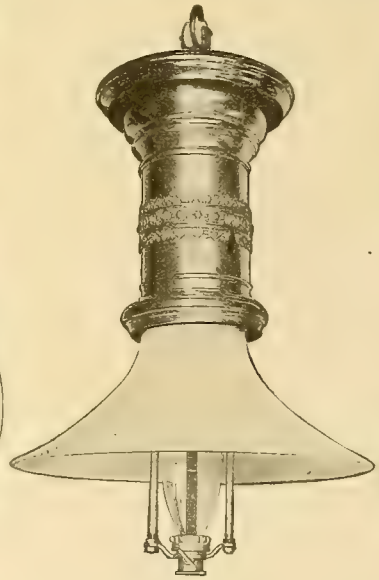


Fig. 3.

Fig. 4.

ZECO ARC LAMP

On the direct-current lamp is a simple adjustment in the resistance to take up any voltage variation, and a further adjustment is accomplished by three loops cutting out sections of the solenoid winding. The lamp may be regulated to pass from three to six amperes, as may be desired, giving proportionate candle power. The armature acts as a plunger for the dash-pot, and, being large, does not require a mechanical fit, thus obviating the possibility of a binding action.

The lamp is furnished for operation upon direct-current circuits of 110 to 120 and 220 to 240 volts; also upon alternating-current circuits 110 to 125 volts. The standard lamp is type "A," Fig. 2, and is 27 inches long over all. These lamps are thoroughly ventilated, although all openings are concealed, which renders the lamp impervious to dust and moisture, and equally suitable for in or outdoor use. The telescoping rods, which hold the globe while lowered, are so cushioned as to prevent the possibility of breakage during the trimming.

The direct-current lamps use a special solid carbon and the stub of the upper carbon is transferred to the lower, so that but one carbon is used at a trimming. The life of a carbon is about 150 hours.

In type "A" (Fig. 1) the globe is released by a slight upward pressure of a button at the bottom of the globe holder, and this allows the globe to drop the length of the supporting rods. Type "B" is similar to type "A," except that the globe is closed at the bottom, being suspended from the upper casing.

Type "C," Fig. 3, is useful where an intense downward flood of light is desired; with opalescent inner globe, the light is sufficiently subdued to protect the eye and yet is brilliant. Its length over all is 24 inches.

The same simplicity has been carried out in the design of the alternating lamp. By the peculiar construction of the reactance coil the hitherto objectionable features of undue heat and noise have been entirely eliminated. The alternating lamp is designed for operation directly upon a secondary circuit of from 100 to 125 volts. It will burn for about 80 hours with one pair of carbons, requiring 4½ amperes and 75 volts at the arc. A reactance coil is placed in the hood of the lamp with adjustments, enabling its use on circuits of either 7,200 or 16,000 alternations per minute. It is noiseless, free from overheating and remarkably steady in its operation. The best results are obtained by the use of one solid and one cored carbon. The light is clear, white and steady, and not noticeably less brilliant than that of the direct current.

The process of trimming is exceedingly simple, and is, in fact, a very strong feature. After the globe is lowered (Fig. 4) the lower carbon holder is removed by the loosening of a set-screw and the lower carbon holder withdrawn. The upper carbon holder is dropped to a stop and is removed and placed in the lower holder for the lower carbon. The new upper carbon is, by a slight pressure, forced up into the upper carbon holder. The replacing of the lower carbon holder and the raising of the globe completes the trimming of the lamp. The inner globe is easily removed for cleaning when necessary.

Street Lighting in Washington.

The streets of Washington are extremely difficult to light satisfactorily during months when the trees are in leaf, on account of the dense foliage, which prevents the light being thrown to any considerable distance. The electric lights are all provided with long arms reaching out into the street as far as consistent with safety, but even this is not entirely satisfactory. The lights are so strong that it is the cause of constant complaint from the occupants of houses in close proximity to them, while midway between lamps the light is frequently so intercepted by the foliage as to render the lighting of the entire street very unsatisfactory. While the requirement of a thousand candle power has heretofore been insisted upon by Congress, it is believed that lamps of less power, placed closer together, would give a much more uniform distribution of light at slightly increased expense.

The present law does not require the lamps to be lighted until 45 minutes after sunset. This is believed to be too great an interval. Electric lights have been, until recently, used almost entirely upon the business streets, and the light from stores provided some illumination until the street lamps were lighted. With the increase in the number of electric lights and their establishment upon residence streets provided with heavy shade trees, it has been found that this service is entirely inadequate. The streets become inconveniently dark long before the time for lighting, and upon cloudy evenings many of the streets well provided with shade trees become almost dangerous from the dense darkness. A schedule causing the lights to be started at 15 minutes after sunset is demanded by the public.

Congress has made an appropriation for experimental lighting, and investigations in this line will be conducted during the coming year.

Detroit's Electrical Service.

One of the storm points last week was Detroit and the electrical features of the public service were badly crippled for a time at least. The Detroit Journal, summing up the situation in the midst of the trouble, presented the following statement:

"Detroit can communicate with the outside world by the following means:

"The United States mails; one Western Union wire to Chicago, one to Toledo and one to Saginaw; one state telephone line to Mount Clemens. The Postal Telegraph Cable company expects to have all its lines working by night. Neither of the telephone companies can tell anything about the prospects of securing state communication. Each of them has from 1,000 to 1,500 local telephones out of business.

"The Edison company will supply all its customers with light as usual to-night. Only five or six houses were disconnected last night. The Peninsular Electric Light company's house subscribers will all be without light, excepting in the extreme southern district. Its main lines for one-half a mile, with 30 wires, crashed to the ground in the alley back of Michigan avenue at the same time that the telephone wires fell. The lights of the Gratiot avenue and Grand River avenue business houses will not run to-night. The city municipal lighting plant will be in full running order to-night. The Detroit Electric Light and Power company suffered badly, but believes it will be able to furnish light to most of its customers to-night.

"All street-railway lines are running with the exception of the Fort street and the Grand River avenue line, which includes the Myrtle street cars."

Responsibility of Electric Companies.

In an action for damages caused by a fire which was due to electric current, in an unoccupied building in Wichita, Kan., it was shown that the local electric company had carelessly left the wires connected after the tenants had moved out. The trial judge instructed the jury upon the responsibility of the electric company to provide for the safety of the community in which it operated, as follows:

You are further instructed that the defendant company, by the maintenance and operation of its electric-light plant in the city of Wichita, owes a duty to the public generally to construct and maintain its wires in the manner that electrical science demonstrates as the safest to avoid injuries to persons and property coming in contact with such wires; and, if improvements are made from time to time in the construction of or the maintenance of wires and such improvements are proved to be safer than those used before the discovery of the improvement, it then devolves upon the electrical company using the electricity to put in and use such new improvements; and if the company has neglected or failed to do so, and by reason thereof a fire is started from wires that would not otherwise have been started, such failure or neglect to put in the improvements would be negligence upon the part of the defendant.

You are instructed that if you find that the wire in the second floor of the building of the plaintiff was under the management or control of the defendant or was connected with other wires of the defendant company and by reason of such connection the wires in the plaintiff's building became charged with a current of electricity and became "live wires," and if you find that the fire in the plaintiff's building was caused by such "live wires," then you should find for the plaintiff unless you find that such wires in the plaintiff's building were maintained in a safe manner and according to the judgment of persons skilled in the use of electricity.

Electricity in the Navy.

Captain Bradford, chief of the Bureau of Equipment of the Navy Department, regards with much concern the constantly increasing demands for repairs and renewals for electrical outfits and supplies for ships. With the notable exceptions of Dewey's fleet and the Oregon, the experience of our warships would seem to indicate that they cannot long be self-sustaining without dockyard electrical work. The number of officers who are familiar with electrical engineering seems to be decreasing rather than increasing, probably owing to the closing of the torpedo school, where a course on electricity was taught. In the meantime electrical apparatus on shipboard has multiplied many fold and become, like all other accessories of a man-of-war, much more complex. The Navy Department officials have earnestly recommended that a special corps of men be provided to care for the electrical plants. In his report to the secretary of the navy Captain Bradford says that as a monopoly practically controls the most important electrical supplies, with the usual high prices, he considers it advisable to erect at the New York navy yard sufficient appliances for the manufacture of the articles now purchased.

Electricity in Coal Mining.

Wonderful improvements have been made in the mines of the Cumberland and Elk Lick Coal company and the Merchants' Coal company in the Elk Lick region, on the Baltimore and Ohio railroad, in Pennsylvania, about 25 miles from Cumberland, Md. A correspondent of the Baltimore Sun gives the following details of the changes:

The Cumberland and Elk Lick Coal company has put in a Westinghouse electric generator. An insulated trolley cable traverses the various headings. The squatty, odd-looking motor, which supplants the mule, weighs eight tons and pulls 20 or more loaded mine cars on a trip. The mine has also in successful operation an electric pump, which keeps the wet portion clear of water.

The electric plant of the Merchants' Coal company is utilized in undermining the coal. The digger consists of a motor stationed on a sliding carriage and propels an endless chain, upon which are a number of steel claws, not unlike the teeth of a large circular saw. The machine is stanchly braced up against the breast of the coal and the current turned on. The chain begins to revolve rapidly and the claws are forced into the coal, cutting clear and clean 42 inches wide to a depth of seven feet under the coal in a few minutes. This operation is repeated until the full width of the breast is undermined. The machine is then loaded upon a truck, requiring but a few minutes, and is removed to another room. The miners of the room that has been undermined "put in a shot" and discharge it, knocking down the entire breast of coal. As high as 11 cars of coal have been loaded from one shot. In a few weeks two machines in each of the three mines will be in successful operation.

Electric Power for Washington.

The House committee on the District of Columbia has decided to make a favorable report on the Senate bill providing for the acquiring by the United States of the property at Great Falls on the Potomac. The property will be acquired by condemnation, and will give the United States exclusive jurisdiction over the water rights at Great Falls, enabling it to greatly increase the water supply at Washington and to utilize, if desired, the power for the illumination of the city and the government buildings. It is believed that the property can be acquired for $300,000 to $500,000.

There is at Great Falls a dam 150 feet in height, which is to be made even higher. General B. F. Butler owned the property on the Virginia side, and proposed to erect a manufacturing center, but Washington needed the water itself and the scheme came to naught.

There is, however, behind the proposition of acquiring this property more than the securing of an increased water supply for Washington. It is desired that the United States shall be in a position to utilize the water power at the falls, if it should ever wish to do so, to illuminate the streets and public buildings of the city. There is ample power for that at present, and even enough to run the electric roads and furnish electricity for other purposes, should the government desire to do so. It is unlikely, however, that the government would ever undertake to make a commercial enterprise of it, but the possession of facilities for erecting and maintaining such a plant would render it less subject to the extortionate demands of the electric-lighting corporations. The bill may meet with opposition from these companies, as well as from others who hope to secure the power for private uses. Its passage would be a severe blow to those who cherish the hope that Washington is some day to become a great manufacturing center.

St. Louis Street Railways.

There has been much speculation as to the moving spirit in the street-railway deal in St. Louis, but the people of that city now feel that the purchasers of the National railway lines are W. T. Elkins, P. A. B. Widener and the coterie that controls the Metropolitan company of New York. "Brown Bros., the Wall street firm," according to a dispatch, "which is managing the deal, is known to be acting on the instructions of the Elkins-Widener syndicate, as the backers of these street-railway enterprises are familiarly known. The deal is working out to the satisfaction of the persons most directly interested, and it is thought within the next 10 days every share of stock in the properties will be turned over to the New York representatives of Elkins and Widener. Notices sent to stockholders in both systems to call at the St. Louis Trust company and turn over their stock are bringing responses right along."

Following quickly on the sale of seven street-car lines controlled by the National company, as represented by the Hamilton syndicate, for a consideration of $3,500,000, comes the announcement of the sale of the entire Lindell system to a syndicate represented by Brown Brothers for $8,500,000. The deal was closed recently and the papers signed. This sale takes in the Page avenue division, Taylor and Finney streets, Delmar avenue, Chateau Park and Spalding avenue divisions. A few weeks ago the Lindell Railway company had the life of its franchise extended for 50 years, after a bitter fight in council, the mayor signing the bill over the protest of many prominent citizens.

Should Brown Brothers secure the Union Depot lines, now controlled by John Scullen, there would be practically nothing to prevent the combination of all the traction companies of the city, operating 284 miles of single track.

Joseph Leiter's Compressed Air.

Among the manifold activities of Joseph Leiter, ex-king of the Chicago wheat market, the control of compressed-air appliances outside of the United States is now reported. The following paragraphs from an interview in the Chicago Tribune show how the wind blows:

"It is true that I am interested in compressed-air power," Mr. Leiter said, "having secured control of the International Air Power company, which holds exclusive rights for all countries other than the United States. Steps have been taken toward the formation of a large company in London which will take over the rights held by the International company and introduce the power into various countries.

"It has been demonstrated that compressed air is more satisfactory than any other means of propulsion for automobile vehicles. The storage battery is heavy—a fault that so far has proved ineradicable. But that is not the only fault. The jarring of vehicles running over rough pavements shakes the battery plates to pieces before their power is exhausted, and the result is great waste in energy. There is the kerosene engine, which, besides its bad smell, has objectionable features as a mechanical device. It has no cut-off in the cylinder. If its power is in use at all it is in use at full force. Compressed air can be used with as perfect a cut-off as is found in the Corliss engine, which means that no power is wasted in application.

"Will compressed air take the place of the electricity for street railways? There is reason to expect it will in time. The cost of installation for a compressed-air system is about equal to that for an electric system. In cost of operation and maintenance compressed air, even at its present state of development, has slightly the advantage. When it has become generally known and conceded that it is more economical it will come into wide use.

"But the difference in cost is not the greatest item in its favor. Most European cities refuse to permit the laying of tracks in their streets or the stringing of trolley wires. In such places, where no vehicles can be used except such as can go in any street, compressed air has manifest advantages. With compressed air each vehicle is independent. It requires no wires and does not depend on the operation of any other mechanism."

CORRESPONDENCE.

New York Notes.

New York, December 12.—It is now stated, on the authority of John D. Crimmins, who was formerly prominently connected with the Metropolitan street-railway interest, that the mysterious "$25,000,000 company" frequently mentioned in this correspondence, was established by William C. Whitney and eight associates. This company—the New York Gas and Electric Light, Heat and Power company—was incorporated early in October; and it is said that Mr. Whitney's ambitious scheme is the consolidation of the electric-lighting interests of Manhattan Island, with a close alliance with the Metropolitan Street Railway company. To this end, according to Mr. Crimmins, Mr. Whitney and his associates have already secured control of the Mount Morris Electric Light company, the Manhattan Electric Light company, the Edison Electric Illuminating company and the Empire City Subway company. However, the Sun, which has exceptional sources of information on Wall street, intimates that Mr. Crimmins is no longer on the "inside" of Mr. Whitney's business deals. It states that the prime mover in the new $25,000,000 company was Roswell P. Flower. "Associated with him," to quote from the yesterday's issue of the same newspaper, "were Anthony N. Brady of Albany and a few others, including William C. Whitney. This company was incorporated for the purpose of supplying electric light, heat and power in Greater New York. The company will begin business on or about January 1st. Since its incorporation the company has acquired an interest in the New York Telephone company. The New York Telephone company controls the Empire City Subway com-

pany and the subways of the Consolidated Telegraph and Electric Subway company—practically all the subways in New York. The interest acquired by the new company in the New York Telephone company enables the former to use all the high-tension wires—those supplying power and heat. The telephone company retains control of the low-tension wires for telephone purposes only. The Edison Electric Illuminating company controls the Manhattan Electric Light company, and it is possible that before January 1st the new company will have acquired the controlling interest in both these companies. It has not done so as yet. Negotiations are pending between Mr. Flower's company and the Mount Morris Electric Light company, but nothing has been definitely settled yet. There is absolutely no connection between the New York Gas, Electric Light, Heat and Power company and the Metropolitan Street Railway company."

In his statement Mr. Crimmins said that he had no connection with the scheme. It will also be noticed that nothing has come out as yet to indicate that the company will supply gas, although the word "Gas" is a part of the title. The only large electric-lighting company in Manhattan which is not at present mentioned as a part of the combination is the United Electric Light and Power company. This company has a capital of $5,000,000 and operates six stations, using Westinghouse alternating-current apparatus. It has been mentioned as a possibility that the new company may include, through the Kings County Electric Light and Power company (the Flower syndicate), the electric-lighting business of Brooklyn in the gigantic operations which are in prospect.

Hiram Maxim, the American inventor who achieved wealth and fame in England, lectured before the Engineering Society of Columbia University on Thursday last. He spoke of rapid-fire guns and air-ships and is not reported to have dwelt on his electrical experiment.

The Eighth avenue conduit electric-railway line is now in operation. It now extends as far as the junction of Canal street and Broadway, where down-town travelers are transferred to the cable cars. Probably before the end of this week electric cars will be running along Sixth avenue to the Canal street terminal. The Sixth avenue cars now run as far as Fourth street, but the work of installing the new system on this route as far as Canal street is nearly completed. The extension of both these lines as far as Rector street is also well advanced, while the work of laying the Vesey street branch tracks has been carried as far as Church street.

The offices of the Rapid Transit commission—which my readers have not heard of for several months, but which is still in existence—were in the Home Insurance building, which suffered severely in the big Broadway fire. No important papers were lost in the fire. A meeting of the commissioners was held last week, but no business of consequence was transacted.

An important conference of representatives of electrical, insurance, architectural and allied interests of the country was held last week at the rooms of the New York Board of Fire Underwriters to consider a proposed revision of the National electrical code governing the installation and operation of electrical apparatus throughout the United States. The rules were discussed section by section, and several minor changes were suggested. Among the organizations interested are the American Institute of Architects, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Street Railway association, the Factory Mutual Fire Insurance companies, the National Association of Fire Engineers, the National Board of Fire Underwriters, the National Electric Light association and the Underwriters' National Electric association. M. S.

PERSONAL.

Henry L. Doherty, general manager of the Madison Gas and Electric company of Madison, Wis., was in Chicago on Monday.

At a meeting of the board of directors of the Electrical Exhibition company on December 7th H. L. Shippey was elected a director and vice-president in place of F. W. Roebling, who resigned.

J. G. Ihmsen, manager of the Keystone Telephone company of Pittsburg, visited Chicago last week. Mr. Ihmsen is not a frequent visitor in this section, and his many friends in the telephone trade made him doubly welcome on this account.

Judge John W. Showalter of the United States Circuit Court of Appeals died at Chicago on Saturday of pneumonia. Many important electrical cases were tried before Judge Showalter, including the incandescent lamp and telephone litigation.

Frank J. Gould, the youngest of the sons of the late Jay Gould, has reached his majority, and it is expected that he will soon be elected to membership in the directories of the various Gould properties. His three older brothers are on these boards, but each has some interest to which he devotes his special attention. George J. Gould is especially active in the management of the Missouri Pacific system, Edwin looks after a big match company, and Howard, who was elected to membership in the New York Stock Exchange on February 24, 1898, will go into Wall street on his return from his wedding trip. Frank J. Gould has always taken a particular interest in the Western Union Telegraph company, and it is believed that he will turn his attention chiefly to the affairs of that corporation.

NEW INCORPORATIONS.

The Kalamazoo Electric company is incorporated with W. A. Foote, president; S. S. Hobart, secretary, and J. B. Foote, treasurer.

The Carter-Hayes Electric company of Louisville has been incorporated, with $5,000 capital stock, and S. V. Carter, E. W. and P. C. Hayes incorporators.

The Electric Haulage and Manufacturing company of Brazil, Ind., has been formed; capital stock, $10,000; directors, J. H. McClelland, E. C. Morgan and C. B. Niblack.

The Victor Electric company of Chicago has certified to an increase of capital stock from $2,400 to $6,100, and to an increase in the number of its directors from three to five.

Judge Minor, in the Law and Equity Court, at Richmond, has granted a charter to a construction company, formed for the purpose of erecting a plant in that city to be used for the development of the water power of James River. The power so developed will be used in the generation of electricity to supply light and power for manufacturing purposes. The corporation will be composed of prominent capitalists of Richmond and Baltimore. The capital stock of the company is to be not less than $5,000 nor more than $100,000, to be divided into shares of $100 each. The officers for the first year shall be: President, R. Lancaster Williams; vice-president, F. C. Todd of Baltimore, Md.; secretary and treasurer, A. W. Weddell of Richmond; directors, R. Lancaster Williams, F. C. Todd, J. W. Middendorf, John L. Williams and John Skelton Williams. The application for the charter was signed by F. C. Todd, R. L. Williams, E. Randolph Williams, Carl H. Nolting and Charles B. Holladay.

ELECTRICAL SECURITIES.

The Commercial Cable company of New York has declared a quarterly dividend of 1¼ per cent. and an extra dividend of one per cent., payable January 4, 1899.

A controlling interest in the Baltimore City Passenger Railway company has been secured by the Baltimore and Northern road. The Baltimore and Northern has been merely a suburban feeder for the City Passenger.

The Redlands Electric Light and Power company of San Bernardino, Cal., has filed for record a trust deed to the property of the corporation, to secure the Union Trust company of San Francisco in the sum of $400,000, for bonds to be issued.

Stockholders of the old Chicago South Side Rapid Transit company have decided to carry their complaint against a lease of the road to the City Railway company into court. They claim the old franchise was not salable to the reorganized company. They also oppose the proposed lease to the City Railway on the ground that the Allen law prevents the consolidation of competing lines. The lawyers who have considered the legal phases of a lease to the City Railway interpret the clause literally, and maintain that there is no consolidation proposed. Little has been heard of the lease proposition lately, and it is now believed that the South Side people will not be satisfied with a guaranty of four per cent., when the road should earn that amount or more next year.

Once more the announcement is made that the Northwestern Elevated company of Chicago has arranged for the capital with which to proceed with construction work. It is said that a loan of $4,500,000 will be secured, running a year and a half, bearing five per cent. interest, and secured by $5,000,000 of Northwestern bonds. The purpose of giving a note instead of selling bonds at this time is said to be that the bonds may be held back from the market until the road is built and in operation, when the market would doubtless be improved. The new plan is understood to have been submitted to the principal stockholders and to have secured their approval. Securing consent from all the stockholders will be merely a formality. It is said Chicago interests will place $1,500,000 of the loan.

The annual report of the Boston Elevated Railway company, its first since the West End railway was succeeded by the new corporation, shows a gross income of $9,179,096 for the fiscal year ended September 30th. This comprised $8,967,587 earned on passenger traffic, $20,097 on carrying the mails, $32,950 on tolls from other roads using its tracks, $63,585 from rentals of its buildings, $61,150 from advertising in the cars, $19,946 from interest and deposits and $13,778 from various other sources. Operating expenses were $6,566,584, and charges, rentals, dividends, etc., swelled the total to $8,965,019, leaving a balance of $214,077. The number of revenue passengers carried during the year was 181,321,295. The number of car-miles run was 32,209,150.

Announcement is made that the Brush Electric Light company of Baltimore is now controlled by the Westinghouse Air Brake company, and George Westinghouse is the president. It was understood that another syndicate, headed by E. B. Smith of Philadelphia, was endeavoring to obtain control of the Northern and Edison companies, rivals of the Brush, with the view of consolidation, and the matter was under consideration. But the Philadelphians said that the representations made as to the condition of the two companies were not in keeping with the facts, and they called the deal off. The Brush defaulted on its special mortgage bonds last November. In making an offer Mr. Westinghouse agreed to take these at half their face value at cash or exchange them for Westinghouse Air Brake stock. The cash proposition was accepted. The special mortgage, which was the third obtained by the company, is now merged into stock and the dividend passed in November is guaranteed.

MISCELLANEOUS.

The Bureau of Supplies and Accounts of the Navy Department is inviting sealed proposals, until December 20th, for furnishing the navy yard at Portsmouth, N. H., with one steam engine and one direct-current dynamo. Specifications, blank forms of proposal and all necessary information will be furnished upon application to the navy yard at Portsmouth or to the bureau at Washington, D. C.

TRADE NEWS.

The John Kammer company of 176 Indiana street, Chicago, reports that it is much gratified by the receipt of numerous orders for its New Rival incandescent lamp. Users who have taken the trouble to give this lamp a careful test pronounce it highly satisfactory, it is claimed.

The E. P. Allis company of Milwaukee has received a cable order for two engines for an electric-lighting station in London. The Allis company also received an order increasing the original order of the Metropolitan company of New York for three more engines for its street-railway plant. The original order of the Allis company was for eight engines, and it will now build 11 for the New York concern. The negotiations with Mr. Yen for the mill in Shanghai have also been closed. This mill will be built entirely in this country and a force of men will be sent to China to put it up.

The Western Electric company of Chicago is having a great demand for the Petite enclosed long-burning arc lamp, which is furnished with three styles of ornamental globes and may be provided with glass or metal shades. It shouldl be borne in mind that the light shines through but one thickness of glass and that there is no framework in sight and that the umbrella-shaped shade reflects downward the upward rays from the arc that would, otherwise, be lost. It will be seen that this type of lamp is particularly adapted for outside work, to say nothing of indoor service in stores, restaurants and other places where so much light is usually lost in the illumination of the ceilings. This lamp is made for 110 volts, two in series on 220 volts, five in series on 500 volts, or singly on 220 volts. It is only 20 inches long and is easily trimmed.

BUSINESS.

The Eureka Electric company of Chicago is preparing to exploit its new express switchboard, which is claimed by the maker to contain many novel features.

The Berlin Iron Bridge company of East Berlin, Conn., has recently built for the town of Newport, Herkimer County, N. Y., a bridge having two spans of about 70 feet each. This bridge is of the parabolic type, with steel floor beams and stringers.

The Leather Preserver Manufacturing company, Chicago, now following the somewhat unique business of recuperating old belts, particularly belts that have been oil-soaked and are exceedingly greasy, has added to its factory on School place, Chicago. The office of the institution, however, still remains at 27 West Monroe street. A recent order for the treating of an old belt was received from Nova Scotia.

The Electric Appliance company has taken the general western agency for the Crescent tin shade, which has been designed with a view to displacing the ordinary flat tin shade, and it is being manufactured in such large quantities that it can be sold for even a less price than the flat shade. It is curved in shape to concentrate the light as much as possible and has its bright surface corrugated, to give a good distribution.

The Western Electric company, in order to promptly fill orders, now carries a complete stock of Stanley induction single-phase and two-phase motors. The former are made only in two sizes, namely, one-fourth and one-half horse power, for either 50 or 100 volts and for 8,000 or 16,000 alternations. The two-phase motors range in sizes from one to 40 horse power. A complete stock of motor transformers is also carried.

The supply department of the Chicago Edison company is making a specialty of Hardtmuth cored and solid carbons. These goods were secured by the Chicago Edison company before the increased tariff was placed on articles of this class, and, as a consequence, the company is in position to give its customers benefits that could not otherwise be obtained. The supply department of the Chicago Edison company has been doing an exceptionally good business. In fact, all hands at this time are

very busy, and the prospects for the winter trade are extraordinarily good.

The Electric Machinery company of Minneapolis, Minn., has recently closed negotiations with the National Electric company of Eau Claire, Wis., for the purchase of a complete line of direct-connected generators. The deal includes drawings, patterns and all special jigs and tools for the manufacture of the machinery. The addition of this apparatus to what the Electric Machinery company already has gives it in the direct-connected type a complete line, from the smallest sizes used up to 150 kilowatts, and in the belted style up to 225 kilowatts. Messrs. Boustead and Chalmers, who control the company, have the best wishes of the Northwest.

The Emerson Electric Manufacturing company of St. Louis calls attention to the fact that its improved induction sewing-machine motor makes a useful and acceptable Christmas present for any housekeeper. These motors, having no wearing part except the shaft, are particularly adapted for use by inexperienced persons, and the entire device is easily attached to any make of family sewing machine. The sewing machine is started and stopped and its speed is regulated by a slight movement of the sewing-machine treadle. The company further states that this is not in any sense an experiment, but is thoroughly practicable and fully guaranteed. Purchasers should mention voltage and alternations of current, direction in which hand wheel of sewing machine revolves and style of plug for socket in ordering motor.

The following report on the merits of the Montauk multiphase cable is published by permission of Mayor Josiah Quincy of Boston, at whose request the officials of the Boston Fire Department made an official investigation: "In compliance with your request I have examined the Montauk multiphase cable and hereby report that it appears to be a valuable adjunct for use in any automatic fire-alarm service, depending on the action of thermostatic devices for its operation. I base this opinion on the fact that the cable is so constructed that it is thermostatic throughout its entire length, and will therefore be available for operating the system with which it is connected should a fire occur at any point where it is placed. On this account it is, in my opinion, superior to the isolated thermostats used in the present automatic systems." The report was signed by B. S. Flanders, superintendent of the fire-alarm branch of the department.

ILLUSTRATED ELECTRICAL PATENT RECORD.

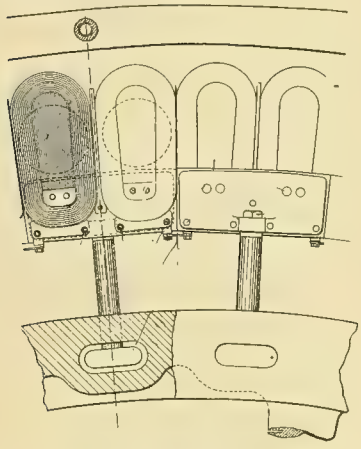
Issued December 6, 1898.

615,246. Electric Battery. Owen T. Bugg, Jr., New York, N. Y. Application filed March 15, 1898.

An electrical battery consisting of a conducting containing vessel having a non-conducting cover, to which is rigidly secured the zinc electrode, is described. There is an inclosed cylinder and active material is packed between the cylinder, and the inner wall of the containing vessel, and means are provided at the bottom of the vessel for securing the zinc electrode.

615,265. Alternating-current Dynamo-electric Machine. Sebastian Z. de Ferranti, Hollinwood, England. Application filed December 28, 1897.

In an alternating-current dynamo-electric machine having a disk armature there is the combination with the bobbins composing the armature of separately insulated supports for the bobbins and means for adjusting the armature radially and compressing the sections after the machine has been in use.



NO 615,265.

615,292. Electric Battery. Maurice Maas, New York, N. Y. Application filed September 7, 1897.

One claim is given: In an electric dry battery the combination of a jar, a cover hermetically sealed thereon, a zinc, a filling within the zinc surrounding a bag containing an absorbent, a hollow carbon having its lower end inclosed by the absorbent and provided with openings in that part, a liquid permeating the filling, bag, absorbent and the interior of said carbon, one or more vents in said cover and porous stoppers for said vents.

615,344. Telephone. Franz Burger and Henry M. Williams, Fort Wayne, Ind. Application filed August 16, 1897.

A telephone apparatus is described comprising a bar, a slidable handle mounted on the bar, contacts controlled by the slidable handle, and a cross-piece supporting the telephone instruments.

615,347. Electric Switch. William Ely, Providence, R. I. Application filed August 14, 1896.

A supporting base or frame and a rotatable shaft with one or more contact knives or blades and a crank secured upon the shaft, an arm open-slotted at one side and rotatably fitted upon the confined end of the crank concentrically with the shaft, and partially embracing the confined end of the crank, whereon it is capable of partial rotation without reference to the movement of the crank and shaft, a cross-head pivotally connected with the free end of the slotted arm, guide means for the cross-head, and an extensible spring connecting the cross-head and the free end of the crank.

615,349. Electric Cable Conductor. Stephen D. Field, Stockbridge, Mass. Application filed December 24, 1897.

A cable conductor is composed of the insulated wires of an electrical circuit and one or more iron companion wires or rods not included in such circuit, the insulated wires and iron wires being interbraided or interlaced.

615,351. Dynamo-electric Machine. John E. Fuller, New York, N. Y. Application filed March 24, 1898.

The revolving armature and field magnet pole pieces, integral with a common connecting base, but, divided up into similar sections at the respective poles, whereby a uniformity of magnetism is set up and maintained in the poles of the field magnet, are the chief features of the machine.

615,365. Electrical Appliance for Elevators. James H. Roberts, Grand Rapids, Mich. Application filed December 27, 1895.

This apparatus comprises the compound-wound brake motor, the controller, the starting and stopping switch, and means for operating the switch and controller from the elevator carriage, the switch having three sets of contacts for forming the circuits at the ends of the movements of the switch, combined with the pair of switches operated from the hoisting mechanism and each having three pairs of contacts and suitable conductors.

615,369. Ore Stamp. David M. Smyth and Joseph E. Smyth, Pasadena, Cal. Application filed November 29, 1897.

The vertically moving ore stamp has a bar of magnetic material, an upward extension of non-magnetic material, a helix surrounding the non-magnetic material and only the upper end of the magnetic material when the stamp rests in the mortar, an electro-magnet, a spring connected to the core or armature of the electro-magnet and acting upon the upper end of the bar of the stamp, and a switch for directing the electric currents through the respective helices.

615,388. Apparatus for Operating Electric Switches. Charles Hartdegen, Newark, N. J. Application filed July 30, 1897.

The combination includes a time-piece, its train of gear mechanism, its winding arbor and a helix on the arbor, and means connected with the switch in engagement with the helix for automatically actuating the switch mechanism and closing the same.

615,395. Circuit Breaker. Frederick A. La Roche, New York, N. Y. Application filed December 28, 1897.

A set of stationary contacts, a movable contact or bridge, a latch engaging the bridge, in combination with two solenoids, a rod suitably supported and situated within the solenoids, each solenoid provided with a plunger, guided by the rod, one of the plungers operating the latch whenever a current exceeding a predetermined limit occurs in its solenoid, and the other plunger operating the latch whenever the current in its solenoid is interrupted.

615,407. Electric Arc Lamp. Moses S. Okun, New York, N. Y. Application filed June 3, 1895.

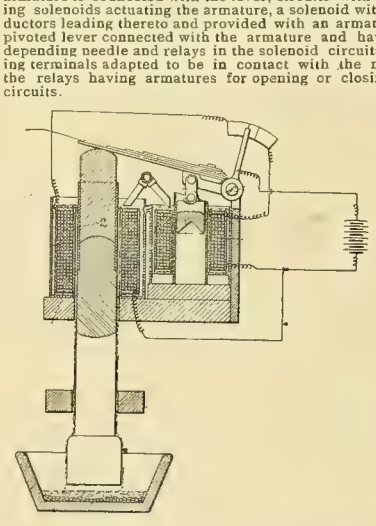
Essential parts are a carbon-operating rod, a carbon holder, means connecting the holder with the rod and permitting the carbon to have independent motion of translation laterally during operation, and means for guiding the carbon.

615,408. Electric Arc Lamp. Moses S. Okun, New York, N. Y. Application filed October 21, 1895. Renewed May 28, 1898.

In an arc lamp there is a globe closed below the arc, and a disk or plate fitting snugly within the globe so as to travel up and down with the upper carbon to retard the access of air to the arc.

615,418. Automatic Rheostat. Eleazer T. Wilkinson, Philadelphia, Pa. Application filed May 8, 1897.

A series of segments is insulated from each other and provided with resistance coils; a lever is suitably fulcrumed and carrying a contact roller for the segments; an armature is connected with the lever, circuits with working solenoids actuating the armature, a solenoid with conductors leading thereto and provided with an armature, a pivoted lever connected with the armature and having a depending needle and relays in the solenoid circuits having terminals adapted to be in contact with the needle, the relays having armatures for opening or closing the circuits.



NO. 615,399.

615,419. Rheostat. Charles Wirt, Philadelphia, Pa. Application filed July 26, 1897.

In a rheostat the combination is claimed with a casing of successive folds of electrical conducting material in series circuit within the casing, detents to secure the conducting material in fixed relation with the casing, a movable contact member, mounted upon the casing, and means to shift the member in direct contact with the successive folds of the conductor.

615,420. Electrical Connection. William E. Baker, Chicago, Ill. Application filed July 13, 1896.

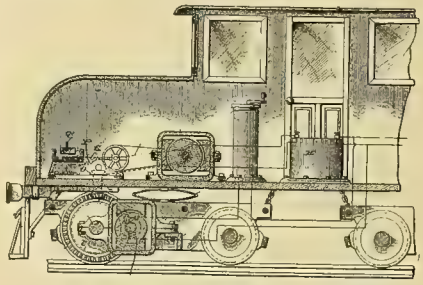
A box is mounted on the adjacent end of each car; a casting is mounted therein provided with a pair of contact-making devices; a link is provided with coöperating contact-making devices at each end thereof, one of the contact devices comprising a cylindrical sleeve forming a socket and the other comprising a plug adapted to be received in the sleeve when in use.

615,471. Reflector. Albert E. Boeschenstein, St. Louis, Mo. Application filed February 28, 1898.

The combination is claimed with a lamp bracket of mirrors supported thereby and arranged at an angle to each other so as to face the exterior, a lamp support supported by the bracket so as to face the interior, and lamps fitted to the support, behind or within the angle of the mirrors.

615,539. Electric Battery. Philip A. Emanuel, Aiken, S. C. Application filed May 17, 1898.

Both the positive and negative elements have passages through them; a porous body separates the elements, the porous body being impervious to a fluid where it registers with the passage through the elements, an exciting fluid or electrolyte, and means for forcing the fluid or electrolyte through the passages in the elements and through the porous body.



NO. 615,592.

615,540. Electric Battery. Philip A. Emanuel, Aiken, S. C. Application filed May 17, 1898.

This is a voltaic pile which consists of a plurality of positive and negative elements placed alternately one above the other with a casing of porous material inclosing the elements, a vessel containing the porous casing, and an electrolyte carried within the vessel.

615,541. Electric Battery. Philip A. Emanuel, Aiken, S. C. Application filed May 17, 1898.

A thermo-electric pile consists of a plurality of thermo-electric couples separated from each other by porous diaphragms and inclosed in a porous casing.

615,584. Block-signal System. William L. Stockton, Trenton, Ohio. Application filed December 20, 1897.

There is a trolley wire having shunt connection with the feed wire, with switch trolley wires at the ends of the trolley wire, but insulated therefrom, a wire connecting the switch wires, a shunt between the connecting wire and the feed wire, an electro-magnet in each of the shunts, a signal circuit and a switch operated by the electro-magnets for cutting in and out a connection between the feed wire and signal circuit.

615,592. Electric Locomotive. Martin E. Thomas, Cassaday, Ky. Application filed July 12, 1897.

A motor is carried by the truck in gear with the axle and a dynamo is carried by the body in electrical connection with the motor, while an engine drives a horizontal shaft with pulleys upon the shaft and a belt connecting the pulleys with the armature of the dynamo.

615,594. Electric Locomotive and Truck. Samuel M. Vauclain, Philadelphia, Pa. Application filed December 29, 1897.

The combination in an electric locomotive of the driving shaft, a crank thereon having an extended sleeve, a wheel secured to the sleeve of the crank and a bearing block in which the sleeve is journaled.

615,652. High-frequency Apparatus. Thomas B. Kinraide, Boston, Mass. Application filed May 13, 1897.

An induction device is provided with a primary having a plurality of turns and means to shift the circuit connection from one turn to another transversely of the turns, at either or both ends of the coil at will.

615,653. High-frequency Induction Apparatus. Thomas B. Kinraide, Boston, Mass. Application filed March 4, 1898.

An induction device having a primary of sheet metal, the turns of the primary being insulated from each other by a saw-cut.

DESIGN.

29,782. Insulator. Jacque L. Morgan, Kansas City, Mo. Application filed September 6, 1898. Term of patent, seven years.

Western Electrician.
EVERY SATURDAY.
Vol. XXIII. CHICAGO, DECEMBER 24, 1898. No. 26

Postal Telegraph Booth at Hebrew Charity Fair, Chicago.

The Hebrew Charity Fair has come to be recognized as one of the established institutions of Chicago, and this year's gathering at the Auditorium was more successful than any former event of the kind, not only as a social affair, but in a financial way as well. Several new features were introduced which contributed largely to the enjoyment of visitors and at the same time enabled the management to realize a considerable sum for the enterprise. Among the most attractive innovations was the establishment of a telegraph service, which was in reality an up-to-date development of the old-fashioned postoffice idea borrowed from church fairs of long ago. The Postal Telegraph-cable company contributed the booth and aided in the organization and management of the affair.

The booth was about 10 feet square and 10 feet high at its highest point, and it occupied the space between the central arches in the foyer of the Auditorium. It was the first thing one saw upon entering, and as it was attractive and unique, it called forth many compliments. The four posts marking the enclosure were telegraph poles, neatly cross-armed and wired. For insulators, green incandescent lamps were used, producing a very beautiful effect. The prevailing colors were white and gold. The four panels were decorated with Postal sending blanks for background, a border being made of the envelopes and the familiar Postal paster. These pasters of blue and yellow were also used to good effect in forming borders and letters. The ceiling of the booth was also ingeniously composed of Postal sending blanks for the center, with a border made of envelopes and Postal pasters.

An excellent view of the booth and the staff in charge is presented in Fig. 1. Mrs. Ben Rosenthal had personal supervision of the affair and was assisted by Miss Hattie H. Marx and the following-named ladies, who filled positions as operators and messengers: Misses Heidelberg, Rebecca Marx, Pearl Eichberg, Grace Eichberg, Fannie Greenebaum, Rose Rosenthal, Fannie Rutter, Blanche Eisendrath, Sadie Israel, Jennie Heyman, Minnie Moss, Josie Moss and Edna Leesem.

It will be readily understood that this booth proved a very attractive feature of the fair and that it was financially successful. The alert, pretty girls, who were dressed in a uniform of white trimmed in blue and gold braid, wearing the regulation Postal messenger cap and badge, kept a vigilant lookout for friends and acquaintances, and before they could escape each visitor found a telegram bearing his address, with the invariable charge of 25 cents, which the envelope stated was for "Sweet Charity's Sake." A group of these messengers is presented in Fig. 2, on page 352. No one escaped their vigilance, and everyone was made happy by some appropriate message prepared for the occasion, which had been stored away in its proper alphabetical box, until the opportunity seemed ripe for delivery. For weeks before the fair opened, messages had been thought out and prepared, and no one begrudged the small payment, for it not only helped the cause, but the message itself was a souvenir of a very happy time; and without exception everyone seemed delighted with the telegraph feature of the fair. The envelopes and message blanks were prepared with a special reference to the occasion, but all bore the impress of the well-known Postal Telegraph trademark.

So capable and enterprising were the managers of this booth, that the Postal officials at Chicago would be glad to add them to their regular force of employes. There never was a better drilled corps of messengers, and their deliveries were astonishingly quick and accurate. The record shows that not a single telegram had to be "reported back for collection."

FIG. 1. POSTAL TELEGRAPH BOOTH AT THE HEBREW CHARITY FAIR, CHICAGO.

Northwestern Electrical Association.

The seventh annual convention of the Northwestern Electrical association will be held at Hotel Pfister, Milwaukee, commencing on Wednesday morning, January 18th. The following papers will be read and discussed:

"Trend of Central Station Design," by B. J. Arnold of Chicago.

"Meter-rate Systems," by E. L. Debell of Sheboygan, Wis.

"Design of Secondary Circuits in Alternating Plants," by George L. Thayer of Belle Plaine, Ia.

"Electricity Direct from Coal," by Professor A. J. Rogers of Milwaukee.

"Inductive Loads on Alternating-current Transformers," by Professor D. C. Jackson of Wisconsin University, Madison.

"Electric Vehicles and Their Relation to Central Stations," by H. M. Maxim of Hartford, Conn.

"Association Management," by H. L. Doherty of Madison, Wis.

Mr. Frank L. Perry of Chicago has consented to

give an illustrated lecture on "Curious Things Electrical," and musical and electrical Indian-club exercises and novel pyrotechnic effects will be presented by Mr. George W. Patterson of Chicago.

Members are invited to mail to the secretary, prior to January 10th, questions on any matter connected with their business upon which information is desired, giving name and address "as an evidence of good faith, not for publication." All questions received will be printed in the second notice, together with a request for prepared answers to be ready at the convention when called for. The usual one-and-one-third fare has been secured from the Western Passenger association, conditioned upon 100 certificates of attendance. The railroad joint agent will be in attendance at the convention on Thursday, January 19th, to countersign certificates. James Wolff, W. W. Low and George S. Whyte of Chicago will have charge of transportation arrangements for delegates coming from or through that city.

The Hotel Pfister will make the usual reduced rates to delegates. Rooms and exhibit space should be secured well in advance. The fact that the Wisconsin Legislature meets this winter makes it important that every central-station plant in the state should have a representative at the convention. A banquet, theater party and sleigh ride are being arranged for, and an enjoyable entertainment for all is assured. Officers will be elected, summer-meeting plans proposed and discussed, committees appointed and other business transacted.

FIG. 2. POSTAL TELEGRAPH BOOTH AT THE HEBREW CHARITY FAIR, CHICAGO.—SPECIAL MESSENGERS

Hungarian Patent Publication.

Americans are proud of their patent system, and while they admit that it shares the fate of all human institutions in lacking perfection, they justly contend that it is so far superior to corresponding branches of foreign governments as to place it safely beyond comparison with the best of them. This condition is impressed upon inventors and patent experts who have occasion to apply for protection in other countries, and an instance of this kind was recently brought to light which will serve by contrast to show how far the Old World is behind the New in this particular.

The United States publishes an Official Gazette every week containing a record of patents granted in this country, but many foreign countries do not appreciate the importance of such a publication. Among those lacking this very important service is the Hungarian Patent Office. An attempt has been made to supply the defect by private enterprise, and a journal has been established to conduct the work. As the total number of patents granted is small, and these mostly to foreigners, it was determined at the outset to print the record in four languages, Hungarian, German, French and English. Here is an extract from the English department of this unique journal:

PROCEEDING AT THE PRODUCTION OF STOCKINGS OF THE LIGHT WITHOUT FLAME OF SPONTANEOUS IGNITION.

Claim

Proceeding at the production of stockings of the light without flame of spontaneous ignition without use of heaters or putting-in of lighters, characterized by a stocking of light without flame of a provenience whatever prepared in such a manner after it's treatement in an alcalic bath by impregnation of one portion of its surface by platina—or iridium—salts, that these salts form ethiops of platina or iridium or the oxydes of incandescence—oxyde of thorium or cerium, etc.—causing the ignition of the stocking at he contact with the mixture of gas and air.

There is reason to believe that the English department of this unique journal is conducted by some one who has had the advantage of a training in a Yankee patent shark's office. At any rate, the owner of the patent mentioned may rest assured that he will not be disturbed in the possession of his invention if the translation of the claim here reproduced is accepted as an official interpretation.

Proposed Patent Legislation.

[Special correspondence of the Western Electrican.]

Washington, D. C., December 19.—The Patent Law association of this city has made a compilation of the bills pending in Congress affecting the patent law, together with the views of the association. Before the organization passed upon any of the bills in question copies of them were submitted to lawyers throughout the country, and criticisms invited. The conclusions presented, therefore, are not merely the views of a few men, but embody the deliberate judgment reached by a long and careful study of the whole field of pending legislation by many representatives of the patent bar and officials especially interested in patent legislation.

The association found that everywhere there was an agreement upon three points: The necessity of carefully studying out some plan to put into the best shape the mass of material piled up in the United States Patent Office so that a thorough search might be made by the examining corps, by attorneys making validity searches and by the public generally in search of information; that there are now too many appeals in contested cases in the Patent Office; that the present arrangement of circuit courts of appeals is a failure as applied to the patent system, and that one final court is wanted whose rulings will cover territory co-extensive with the grant.

A suggestion which seems to met with general approval is that the trademark law shall be extended to commerce between the several states, and that the power of the commissioner of patents should be supplemented by the specific provision of law regulating the admission of attorneys.

The association has been impressed with the necessity of urging upon all persons having to do with patent legislation the great advantages accruing from a broad, general discussion of such legislation, and it is thought inexpedient and impolitic to recommend any radical change in the present system of procedure in the Patent Office, and, at the same time, a radical change, such as the creation of a new court, without weighing carefully the reciprocal relations between such provisions.

At this time it is the judgment of nearly all patent lawyers, so far as they can be reached, that some provision must be made to establish a final court in patent causes. Some desire a separate patent court—the majority, in fact, seem to favor that—while others object to it and would restore jurisdiction to the Supreme Court of the United States, on the ground that there should not be a final court other than the Supreme Court for a special branch of law.

The association, in common with the patent bar throughout the country, has been peculiarly impressed by the necessity of making a firm stand against the constant tinkering with the patent system by means of ill-considered bills. The subject is one that should not be urged during the present or short session of Congress. It requires the fullest possible consideration and the widest discussion, which cannot be had this session, for the reason that Congress has its hands full in the consideration of appropriation bills and peace treaties. A. F. T.

Electrical and Engineering Work in the Navy During the War.[1]

BY W. D. WEAVER.

The lessons taught by the late war with respect to the employment of electricity aboard men-of-war are few in number, though important in their bearing. The most decisive result was the demonstration of the immense superiority of electricity over steam for the operation of turret-training apparatus—a demonstration so decisive, in fact, that the question of the employment of electric power for this purpose is no longer an open one. The society is to be congratulated that one of its members is the inventor of the system whose application has led to this happy result. I refer to Mr. H. Ward Leonard.

Another question which the test of battle has settled definitely is the superiority of electric ammunition hoists, not only in efficiency in working, but also with respect to location and space occupied, that will tend to greatly extend the application of electric power on shipboard generally.

Against the great success in the particulars just mentioned must be set the failure of electrical range-finding apparatus, and of electrical indicating apparatus in general. As to the first mentioned, the enemy gave so few opportunities for its use, and even then so little necessity existed for its employment in view of the leisurely manner in which our vessels could pick up their range, that possibly neglect had something to do in the case.

At any rate, electrical range-finding should not be condemned in general because of the failure of a single system. In fact, the weak points in the one in question would seem to be easily overcome by the employment of alternating currents of high frequency and considerable voltage, thereby enabling a drop between indicating points to be obtained by means of inductance, which would be in the order of volts instead of possibly millivolts, as where the direct current is used. I will add that an apparatus answering this description has been proposed by Messrs. Crehore and Squier.

As to other indicating apparatus, it should be borne in mind that electrical apparatus of this nature requires a certain amount of expert care, which it is not always possible to obtain aboard ship, while the contrary is the case with the mechanical apparatus that it would displace. If, in anticipation of battle, the latter is thoroughly overhauled, as would be the case, there is more assurance of its efficient working than electrical apparatus under the adverse condition named, notwithstanding the inherent superiority of the latter. This brings up the question of the deficiency aboard ship of necessary electrical skill, which has been made the subject of an official report by the bureau officer in charge of electrical engineering, and will be referred to later on.

The favorable experience with electric power in the important cases just mentioned should accelerate the extension of its application aboard ship, and while, unfortunately, the present bureaucratic tendency is not in that direction, I shall, nevertheless, refer to some other cases distinctly calling for such application.

The one of immediate importance, and which, in fact, can be considered a crying necessity, is that of electric ventilation.

For warship ventilation, both with respect to coal economy and deriving the most efficient results in ventilation itself, the electric fan offers an ideal solution. The modern warship being divided into numerous compartments, each of these can be supplied with its own electric fan or fans, either for isolated ventilation or to supply a system of only such extent as will involve no sacrifice in efficient ventilation. The type of engine now employed with steam ventilators undoubtedly requires anywhere from 75 to 200 pounds, and even more, water per horse power hour. In the case of a large electric plant and with fan motors of the most ordinary efficiency, this would be reduced to considerably below 50 pounds, while, at the same time, the ventilation for a given expenditure of power would be greatly increased in efficiency.

Whether electricity should also be applied to furnace blowers for forced draught is an open question at the present moment, in view of the very infrequent use of such blowers and consequent large idle electric plant normally that would be entailed.

Other employments of electric power, so obvious that their adoption cannot be greatly delayed, are in driving the workshop and ice machine, now installed aboard every warship. The engines of the latter are particularly inefficient, aside from their immense inconvenience through the heat given forth. In these cases the application of the electric motor is so simple that it cannot be open to question, and the same remark applies to winches and ash hoists. On the ship of which I was chief engineer there were six of these, which, I estimated, consumed steam at the rate of over 150 pounds per horse power

1. Read before the New York Electrical Society, December 14, 1898.

hour, not counting the great condensation in the long lengths of steam-supply pipes.

Steam pumps are, as is well known, grossly inefficient in steam consumption, and the same is true to a lesser extent of other auxiliary machinery connected with the propelling engines. While it may be claimed that it would be inadvisable to render the operation of the propelling machinery, particularly in time of battle or during storms, dependent on obtaining power from the electric mains, in reply it may be said that the number of different engines at present employed to run the auxiliary machinery is in itself a great hazard, for the breaking down of almost any one would alone affect the operation of the main propelling machinery.

Among other probable applications of electricity in the future are the anchor hoists and steering gear. The navy has had a somewhat unfortunate experience with the latter, and this, by the way, carries a lesson with it for those interested in introducing new electrical machinery aboard warships.

The lesson is that in every case possible such machinery should first be tried aboard merchantmen, and all experimental work entirely completed before attempting to secure adoption by the navy. In many cases it would possibly not be a difficult matter to find opportunities for making the trial on coastwise or freight steamers, or on harbor vessels, though sometimes, however, at the expense of those putting the apparatus aboard.

Steering gear and anchor hoists now furnish good subjects for the electrical designer, and if previously tested in the manner described, would undoubtedly stand an excellent chance of adoption for use in the navy in the near future.

As I have intimated, it must be reluctantly acknowledged that, notwithstanding the extremely efficient showing which electricity made during the late war, it is apparently at the present moment not in high favor at the Navy Department. The chief of the bureau having charge of electrical matters has recently reported very gloomily concerning the difficulty experienced aboard ship in keeping the generating plant in an efficient state; and the Naval Board of Construction has recently refused to further extend the application of electricity on shipboard, the decision being that the use of electricity has gone far enough for the present.

It is quite probable that this unfortunate decision was arrived at owing to the unfavorable condition referred to concerning efficient operation. Why the operation of an electric plant of the size installed aboard ship should present any considerable difficulty will probably be a puzzle to those here present who are conversant with electrical operation ashore, as it would also to those familiar with merchant-ship electric lighting. The clue is given, however, in a remark by the bureau chief as to the difficulty met with in obtaining an efficient operating force, the fault thus lying, it is to be surmised, not with the electrical apparatus, but with the electrical personnel.

In view of the manner in which professional pride and the electrical industry are thus affected, it would appear entirely appropriate for the electrical fraternity to use its influence to have the appropriate remedy applied to the serious defect which has thus been officially acknowledged to exist. What this remedy should be might well prove the subject of a departmental, or even of a congressional investigation. That it is due to a faulty system, and not chargeable to lack of zeal on the part of the officers affected, can, I believe, be taken for granted.

Trees Which Draw Lightning.

[From the St. Louis Globe-Democrat.]

Alex. McAdie has asked the Weather Bureau to investigate the question why some kinds of trees are more frequently struck by lightning than others. Apart from the importance of this subject from other points of view, it demands attention primarily as a matter of saving human life. As Mr. McAdie shows, many people, particularly farmers and those who work in the fields exposed to thunderstorms, will work until the storm is almost upon them and then run to the nearest tree for shelter.

If the tree is an oak, and the charged thunderclouds are moving toward it with high electrical potential, the person or persons under the tree are in the line of strain and all unconsciously are contributing to the establishment of a path for the lightning discharge through themselves. On the other hand, if the tree selected for shelter happens to be a beech-tree, there is some reason to believe that it will afford safety as well as protection, though the reason why is not at present made clear. It is known that the oak is relatively the most frequently and the beech the least frequently struck.

Based on the somewhat loose figures on the subject heretofore available, it is estimated that in the matter of relative attraction of lightning, if the beech is represented by 1, teh pine tree stands at 15; trees, collectively, rank about 40 and oaks 54. The trees struck are not necessarily the highest or most prominent. Oak trees have been struck twice in the same place on successive days. Trees have been struck before rain began and split, and trees have been struck during rain and only scorched.

It is suggested that the division of forestry and the division of vegetable pathology shall combine with the Weather Bureau in an exhaustive investigation of this subject, and that those familiar with the forests in their respective neighborhoods will tender their experience as to the relative frequency of lightning strokes on different kinds of trees. But before any statement is made as to the danger of standing under certain trees during thunderstorms, the more general questions of the effect of lightning upon trees will have to be gone into. Such a study will deserve the co-operation of statisticians, physicists and vegetable pathologists.

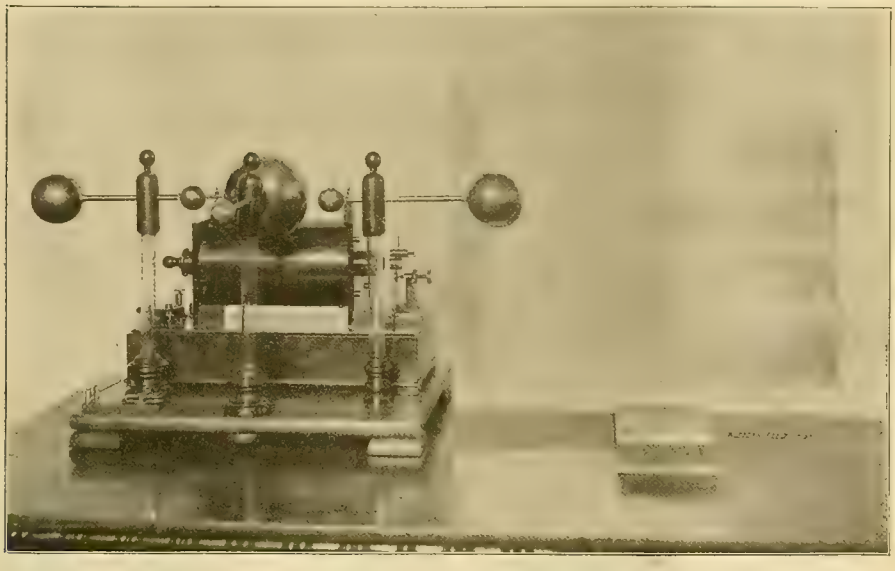


FIG. 1. WIRELESS TELEGRAPHY.—TRANSMITTER.

Wireless Telegraphy.

The members of the Chicago Electrical association listened to an interesting address by Arthur Vaughan Abbott of the Chicago Telephone company, December 16th, on "Wireless Telegraphy," which he illustrated with apparatus similar to that employed by Marconi and other experimenters in this field. Mr. Abbott explained that his apparatus was crude and inefficient, but it answered the purpose of illustrating the theory of the system. Fig. 1, in the accompanying reproductions from photographs of the instruments employed, is the transmitter, and Fig. 2 the receiving machine, while Fig. 3 is a part of the latter, being the coherer tube.

Mr. Abbott explained the essential features of the Marconi apparatus and the American modification employed by W. J. Clark in the exhibition of the New York Electrical society. In the former the transmitter is an induction coil. By means of a telegraph key the current from the battery exciting the coil may be interrupted at pleasure. The sparks delivered by the coil take place between large brass knobs that are immersed in oil. As long as the key is depressed, sparks will occur between the knobs, and waves will be emitted in all directions. The receiver consists of a glass tube, in the center of which is placed some fine silver filings. From these filings wires are extended through the ends of the tube and terminate in large metal wings, which serve to collect the waves initiated by the sparks. From these wings there is a circuit containing a battery and a telegraph relay. There is also an electromagnet that operates a small vibrating hammer, the function of which is to constantly tap the glass tube in order to destroy the residual cohesion when no waves are being received. Normally, when the key is open, the coil is not excited, no sparks pass, no waves are set up, the resistance at the receiver is so great that [illegible] electrical waves radiate in all directions and impinge upon the wings, causing the metallic particles at the receiver to cohere. The resistance enormously decreases, the relay is excited and emits the well-known click of the ordinary telegraph sounder. Simultaneously the hammer gives the coherer a little tap that destroys cohesion and resets the tube in condition to receive another wave. So, by manipulating the key the relay may be made to tick out the familiar

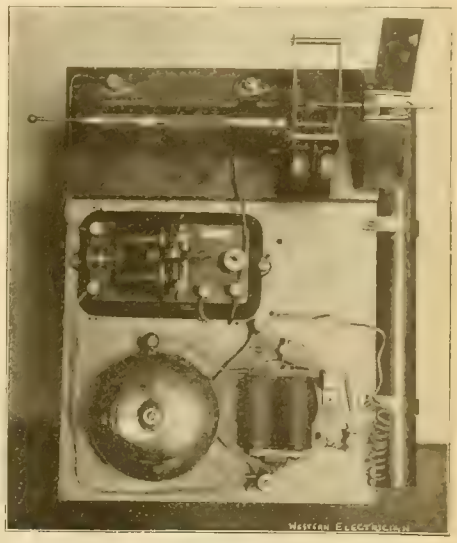


FIG. 2. WIRELESS TELEGRAPHY —RECEIVER.

Morse alphabet, and sentences may be thus transmitted with no connection between the receiver and transmitter but that of the all-pervading ether.

During his experiments in England, Signor Marconi succeeded in sending intelligible signals over a distance of more than four miles; but his greatest feat was in transmitting messages across Bristol Channel, a distance of 8.7 miles. An advancement has been made upon this record by the British postal authorities, who report the successful transmission of messages from Bournemouth to the Isle of Wight, a distance of 18 miles over the English Channel. The special field for the application of this system is generally recognized as being in transmitting messages between vessels at sea.

One feature of the American modification of Marconi's apparatus that appealed particularly to Mr. Abbott was the employment of metal plates for emitting and absorbing the electric waves. Mr. Clark's researches showed that these plates should be of proper size and perfectly parallel to each other in order to get the best results with the present imperfectly developed apparatus. This fact suggests a weak point in the system which was discussed by Mr. Abbott. It must be borne in mind that Marconi's apparatus cannot direct the waves it evokes, and that it is necessary to expend at the sending station sufficient energy to fill to repletion the sphere of space of which the transmitter is the center and the receiver but a mere point on the surface. Applied to transmission over long distances, such an expenditure of energy becomes commercially appalling, so that, unless some means of giving the waves a predetermined direction shall arise, the reliable old wire, along which the electric pulsations conveniently slip, promises to remain a familiar object. In special cases, such as intercommunication between ships at sea, the transmission of signals between moving objects, like railway trains or army corps, or in the emergency of a broken cable, wireless telegraphy may, and probably will, prove itself of immense value; but these are the exceptions rather than the rule, so it now seems as if the existing methods of electric signaling are likely to remain unchanged for some time, at any rate.

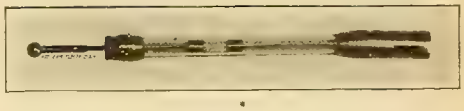


FIG. 3. WIRELESS TELEGRAPHY.—COHERER TUBE.

Another serious objection arises in the necessity for exact adjustment of the transmitter and receiver. As transmission depends on wave action, both the instruments must, like a pair of sympathetic tuning forks, be in exact unison, or else the waves emitted by one will not affect the other. Tuning is accomplished by varying the size of the wings, and may be readily done when both instruments are so close together that their action can be at once observed. Mr. Abbott related some personal experience he had acquired. He succeeded in transmitting messages from his residence to his office without difficulty, a distance of two miles, but he realized that the natural limitations of the present apparatus would preclude the adoption of the system without radical changes and improvements first being made.

Interurban Electric Railway.

An example of model equipment for a modern interurban electric railway is presented in the plant of the Detroit, Ypsilanti and Ann Arbor Railway company, now operating between Detroit and Ann Arbor, Mich., connecting Detroit, Dearborn, Ypsilanti and Ann Arbor with a number of thriving towns through one of the most prosperous sections of the state of Michigan.

Everything pertaining to this road is of the best quality, and the design of every detail throughout is such as to give reliable and satisfactory commercial results. The roadbed itself was very carefully prepared and the rails are as heavy as those employed in regular steam-railway practice. The overhead construction consists of double figure-eight trolley wires, which, with booster and direct feeders, are so arranged as to give perfect distribution and minimum chance for line trouble.

FIG. 2. INTERURBAN ELECTRIC RAILWAY.—POWER HOUSE OF THE DETROIT, YPSILANTI AND ANN ARBOR ROAD.

The road is a little over 40 miles in length, and the regular equipment for present requirements will consist of 10 large coaches for through express, local and excursion service between Detroit and Ann Arbor, with several smaller cars for local traffic at Ann Arbor. These coaches, which are over 40 feet in length, extra wide and supplied with double trolleys, Westinghouse air brakes of special design and modern improvements, were built by the Barney & Smith Car company of Dayton, Ohio. One is shown in Fig. 1. Each coach is equipped with four 50 horse power standard Westinghouse railway motors of the well-known multipolar type with iron-clad armature—a form introduced by the Westinghouse company which is now generally adopted.

The current is supplied from two power houses, one located at Ypsilanti (shown in Fig. 2) and the other at Dearborn, practically 20 miles apart. These power houses are exactly alike, except as to a few minor points due to local conditions. There are fireproof brick structures with double gables, forming independent boiler and engine rooms, being plain, substantial buildings with just enough architectural effect to produce a pleasing appearance, giving the idea of practical utility.

The generating plant in each station consists of two 450 horse power Westinghouse compound automatic engines direct-connected by means of flexible spring couplings to Westinghouse 225-kilowatt railway generators, with foundations in place for two more units and provision for easy extension of buildings for further increase, as shown in Fig. 3, page 355. Independent condensers are provided, and the plants can be operated condensing or non-condensing, at will. Each boiler room, as shown in Fig. 4, contains three water-tube boilers of nominal 250 horse power rating each, equipped with Roney mechanical stokers, fuel economizers, mechanical draft with relay fans and duplicate feed-water pumps, all compactly arranged with particular regard to operating with a small force of men. Coal and ash-handling machinery is not at present installed, but provision is made for this addition in connection with further increase of the plants.

FIG. 1. INTERURBAN ELECTRIC RAILWAY —CAR EQUIPPED WITH FOUR 50 HORSE POWER WESTINGHOUSE MOTORS.

The current to the distant portions of the line is conducted through feeders in which there is a very considerable drop in pressure at the time of maximum load. To compensate for this the feeders are equipped with boosters, which consist of Westinghouse motors direct-connected to series-wound generators, by which the voltage to the feeder circuit is increased in proportion as the load increases, thus enabling a practically constant pressure to be delivered at the trolley line. It was found that this system of operating was very much more economical than it would be to supply the very great additional amount of copper which would be needed if the boosters were not used.

The switchboards are constructed of heavy marble panels with iron framework of neat design, and are supplied with full complement of instruments, including meters, circuit breakers, switches, etc., for the full control of current under all conditions.

The steam piping throughout the plants is extra heavy to carry a working pressure of 175 pounds, and the arrangement is very carefully designed to give flexibility of distribution, together with stability of construction. The steam passes through large separators before going to the engines, and these separators are drained by steam-loops, returning all water of condensation direct to the boilers, all piping being thoroughly covered throughout. Each engine room is supplied with a 15-ton traveling crane. Both plants are located upon the river bank, where a full supply of water is obtained at all seasons. This water passes through cribs with screens to intake wells, and filters are used at the Dearborn plant.

The various kinds of machinery making up these power stations were selected from those known to give the most practical results under the conditions obtaining. The service of such a road, with a comparatively small number of heavy cars to be run at a high speed, necessitates a widely fluctuating load upon the stations. The economy of Westinghouse compound engines under a varying load insures a low steam consumption under regular operating conditions. Similar control is obtained under changing load by the mechanical-draft systems, which enable the draft and consequent rate of combustion to be regulated most perfectly. This refinement is even made automatic by quick-acting regulators, governing the speeds of the fans according to demands for steam. By combining fuel economizers with the mechanical draft, low waste-gas temperatures are secured and the heat is returned to the system, securing a saving in itself without excessive cost or complication. By use of Roney mechanical stokers the cheapest grades of coal can be used with minimum labor in firing.

FIG. 4. INTERURBAN ELECTRIC RAILWAY.—BOILER PLANT.

The engineering and designing of the complete system was done by Westinghouse, Church, Kerr & Co., who also furnished all of the machinery, including car equipments and air brakes.

At the time the Westinghouse company took hold of the work valuable franchises had been secured, and many things had been worked out to show the value of the road, but nothing had been done to determine how the best results might be obtained. This part of the work, as well as that of furnishing all the machinery, was turned over to the engineering concern of the Westinghouse interests upon such a basis that the system might be arranged to meet the conditions from all standpoints, rather than working to a set of specifications with the idea of following them rigidly to fulfill a contract, whether they proved the best or not. Through the method thus adopted the officers of the road were entirely relieved of details, yet, at the same time, in close touch with all that was being done, while the entire responsibility was assumed by the engineering and contracting company.

Electric Street Railroads in England.[1]

By James Boyle.

Heretofore the cities of Great Britain have been among the most backward of any cities of the world in the matter of street railroads. A great change is taking place, however. Undertakings are in progress in the principal cities of the kingdom for the establishment of the most improved systems. In a large number of cases, these enterprises are a feature of a remarkable movement which has been quietly but irresistibly getting control of the government of the chief cities, and may be described as "municipal socialism"—that is, the ownership and operation by the municipality of certain enterprises which by their very nature must necessarily be more or less monopolistic, such as street railroads, electric and gas-lighting plants, the water supply and telephones.

In Liverpool the city government recently has taken possession of the electric-light plant (but not the gaslight) and the entire street-railroad system. In the neighboring town of St. Helens (the center of the English chemical trade) the municipal corporation is to lay the tracks, furnish the cars and equip the routes with overhead trolleys, and supply electric motive power, but will lease the entire system to a company, which will be allowed to charge only certain fixed fares.

A few days ago the first electric street car in Liverpool was started. The line is experimental. It is 2½ miles in length and has a double track. Each motor car has a trailer, the latter being a smoking car. The fare is a penny (two cents) for the trailer and two pence (four cents) for the motor car. The cars are to be fitted with air brakes. In Liverpool, as in most of the other cities referred to, it is intended to use electricity as the motive power for the street cars, although there are those who insist that gas or oil motors are preferable.

Attention is here drawn to this newly awakened spirit of enterprise, so general on the part of British municipalities, in the hope that American contractors and manufacturers may secure some of the work of supplying the plants. The recommendation is made that American firms who manufacture and deal in street-railway and electrical appliances put themselves in communication with the municipal authorities over here. This can be done by addressing the city engineer. As nearly every city and town of importance in Great Britain has such work under progress or in contemplation, it is unnecessary to give a list, and those interested can hardly go astray by addressing the city engineer of any large city in England or Scotland; and the same suggestion holds good, to a limited extent, for Irish and Welsh municipalities. The further suggestion is made that American contractors and manufacturers who desire to bid for such work should have an agent, say in London, who could keep them informed of the undertakings determined upon, so that bids could be promptly made.

There is a general belief, both in the United States and England, that contracts for these public undertakings must be advertised for in the newspapers and must be let to the lowest bidder. I learn, however, from official sources that this is not necessarily so. It is not the case so far as Liverpool is concerned, and I understand that it is not so as regards most of the cities. These great municipal enter-

1. Abstract of special report of United States consul at Liverpool in advance sheets of consular reports, Dec. 14, 1898.

prises are undertaken by authority of act of Parliament. First, certain powers are granted by general acts. Then specific authority to meet local conditions is obtained in one of two ways, viz., (1) either by special local act passed by Parliament, or (2) by provisional order of the Government Board of Trade, which subsequently has its permissive authority or grant of power confirmed by act of Parliament, a number of such grants being "omnibused" in one act. The general public understanding has been that in the parliamentary acts there is a proviso necessitating advertising in the newspapers, and the awarding of the contracts to the lowest bidder. On inquiry, however, I learn that these details are left to the municipal authorities. After the plans and specifications are drawn up, the rule is for the council committee, through the city engineer, to write to concerns inviting bids. On application, the engineer will supply forms, plans and specifications.

Without entering into the domain of politics, it is to be observed that there are two opposing views in England as to the awarding of contracts by municipalities, in so far as foreign competition is concerned. One view (and it is that held by the larger taxpayers, by the gentry and by the professional classes) is that there should be absolute free trade, not only in the importation of merchandise, but in the awarding of contract; that corporations, municipalities and individuals should have no restrictions or conditions whatever imposed in regard to availing themselves of the best and cheapest markets, whether home or foreign. The other view is that municipal contracts should, if practicable, be given to home concerns and home labor, and not necessarily to the lowest bidder. This latter view is that held by the workingmen, and particularly the trades unionists, who, in England, are thoroughly organized and have a potent voice in political matters, both national and municipal.

Within the last two years there has been a widespread agitation in Great Britain against the awarding of public contracts to foreign concerns. This sentiment has been particularly aroused by the bringing over of workmen from the United States to perform public contracts. Were it not for the fact that, for the last 18 months, labor generally has been plentiful here, with fair wages, this opposition would probably have made itself even more manifest. Certain industries, particularly those relating to iron and steel, are very busy in Great Britain now, as there is an accumulation of orders which had to be postponed, because of the recent engineers' strike. It so happens that the movement described above for the "municipalization" and improvement of street railroads and the construction of electric-light plants, etc., became active throughout Great Britain contemporaneously with the labor troubles of last year and the year before. The result was that the British manufacturers were placed at a great disadvantage when it came to making bids for these public contracts, and this applied both to prices and the time in which the work could be turned out. Some municipalities issued advertisements for tenders and gave the contracts to the lowest bidders, even though they were foreign concerns, and a number of American contractors and manufacturers reaped the advantage. The Germans also got a number of contracts for steel rails. Then the agitation arose among the workingmen against giving contracts to foreign concerns, and pressure was brought to bear upon the councilmen and aldermen.

Nearly two years ago the corporation of Liverpool purchased the street-railroad system for about $3,000,000, with the intention of substituting electricity for horses, the details being left to a committee of the City Council. It was decided to build an experimental line, double track, from the center of the city for a distance of about 2½ miles. Although little was publicly said about the matter, the committee was confronted at the outset with the opposition to foreign competition, yet several of the most active of the promoters of the improvement were pronouncedly in favor of a free field and no favor. The first success of the opponents of foreign competition was in the defeat of the proposition to employ an American supervising expert. Bids were obtained for steel rails from a number of firms in England, the United States and Germany. It was discovered that the English bids ranged from 10 shillings to 30 shillings ($2.43 to $7.29) per ton more than the American and German bids. It was claimed that the American and German bids did not fill the conditions exactly as to height and shape of the rail. So the contract for the rails was awarded to a London concern. There was no stipulation as to material, but the distinct understanding was that English rails should be supplied. It turned out, however, that the English concern sublet the contract to a German firm, and all the rails which have been laid on the experimental line, just completed, are marked "made in Germany." The excuse given by the London firm was that, owing to the accumulation of orders on hand, it could not meet the contract in time with English rails.

Last week the committee in charge gave out to a Leeds firm a contract for the rails for an extension of the experimental line. The price to be paid is £7 ($34) per ton. The chairman expressed satisfaction that the rails would be of English manufacture.

So far as the street cars are concerned, the municipal committee found that no English firm could turn them out in time, and so it was compelled to go abroad for the experimental cars. About 50 have been purchased so far, half of them coming from the United States and half from Germany. Nearly all of the electric plant has come from the United States.

I have inquired with particularity from those in authority whether, in the extension of the electric street-railroad system, foreign competition will be invited and accepted if the bids are the lowest and the best. I am informed that, owing to the protests of their constituents, the City Council will not go abroad for any more of the work where it can possibly be done in England, and this will include the furnishing of rails, electric plant and cars. It is better that American contractors and manufacturers should understand the situation as it really exists, and yet I believe it is worth their while to make an attempt to secure some of the work, not only in Liverpool, but in other British municipalities. Within the next few years there will be a great many million dollars spent by the municipalities over here in street-railroad and electric-light improvements. "King's Manual of Electrical Undertakings" gives the aggregate capital of the electrical companies in Great Britain and Ireland for 1898 as $426,426,120. In Liverpool alone, from $5,000,000 to $7,000,000 will be spent for steel rails, electrical plant and cars within the next two or three years. The length of the contemplated street-railroad extensions is about 100 miles.

A heated discussion is going on here as to the best system of traction. The general sentiment is strongly in favor of electricity as against horses, gas or oil as motive power. The experimental line, just completed, is the overhead-trolley system. It has met with much opposition from the standpoint both of æsthetics and of safety. The committee which had the work in charge claimed that the best experts, both in the United States and on the continent, have pronounced the conduit system a failure, and they plead that they were therefore compelled to adopt the overhead system. The probabilities are that the overhead trolley will be used in the extensions, but that the work will be more artistic and lighter than that of the experimental line. In this connection, it is interesting to note that the City Council of Manchester has formally adopted the overhead-trolley system, as opposed to the conduit system, for the reason, as given, that investigations at New York, Washington and Baltimore had demonstrated that the former system was the cheaper and more adaptable to varying physical conditions. There are, however, several systems proposed which, it is claimed, are as cheap as the trolley system and as safe as the conduit system, without the disadvantages of either. Particular commendation is given to a new surface-contact system, the invention of Professor S. P. Thompson of Finsbury Technical College, London, and Mr. Miles Walker of Cambridge.

A British company has just made an offer to the London County Council to place a dozen gas-propelled street cars on the South London lines, at its own expense, with the object of proving that gas cars are more efficient and more economical than electric cars. Large claims are made for the gas motor (which is a German invention, with English improvements); but a Liverpool municipal official who investigated it informs me that it is far inferior to the overhead electric-trolley system.

In London proper, owing to the narrowness of the streets, surface street railroads are, for the most part impracticable; at any rate, in the older districts of that city. There are two underground railway systems in London—the Metropolitan and the Metropolitan District—both using steam. There is now approaching completion a third underground railway, but electricity will be the motive power, and it is gratifying to state that most of the electric plant is of American make. There were recently ordered from America 50 passenger elevators for the use of underground railways in London. The London Times of November 21st gives the following information as to the substitution of electricity for steam on the two old underground railway systems:

"The directors of the Metropolitan and Metropolitan District Railway companies have decided to undertake, at their joint cost, a series of experiments prior to the introduction of electric traction on the Inner Circle lines. For this purpose it is proposed to lay down between Earl's court and High street, Kensington, an electric installation adequate for the hauling of a train which shall be fully as heavy as those now running at the busiest times of the day on the Metropolitan railway. This section of the company's line has been chosen for two special reasons: First, because the ordinary service thereon is not so frequent as that on other sections; and, in the second place, because it contains some steep gradients—as sharp as 1 in 40—which will enable the new electrical system to be tested under the severest conditions that would be experienced in regular working.

"Each company has agreed to put down the sum of £10,000 to defray the cost of the experiments, and these will be carried on without any interruption of the present steam-locomotive traffic for eight or 10 months—a period sufficiently long to demonstrate the practicability of the principle thereafter to be introduced generally on the lines of the Metropolitan and Metropolitan District railways. The contract for the experimental work has been let, and it will be executed forthwith, under the direction of Sir John Wolfe Barry, the consulting engineer to the Metropolitan company, with whom is associated Mr. W. H. Preece, the engineer-in-chief and electrician to the general Postoffice.

"In the first instance, the generating station, erected on land belonging to the Metropolitan District Railway company, at Earl's court, will, in all respects except foundations for boilers and dynamos, be temporary in character. Two conductors are to be laid parallel between each of the lines of the permanent way between Earl's court and High street, Kensington, and these will be permanently available when the electric system is introduced generally on the two railways. The contractors have been instructed to build for the purposes of the experiments two motors, so designed as to form part of the permanent plant, and the train used will be similar to those now running over the Inner Circle. It is expected that the preparations for this important trial will be completed during the summer of next year."

Owing to the enormous volume of traffic, the undertaking will probably be the largest enterprise of any kind in the world in which electricity is the motive power.

The extraordinary awakening in England in the use of electricity extends in a still further direction than that here outlined. There is a scheme under way for connecting Liverpool with the manufacturing towns within a radius of 17 miles, by light suburban electric street railroads, which in the daytime will carry passengers and at night will carry freight. Electric light and power will also be supplied to the towns. There will be a huge generating station at St. Helens. The company has a capital of $5,000,000. There are also organizations springing up for the encouragement of the use of electricity, steam, gas and oil as motive power for freight road wagons.

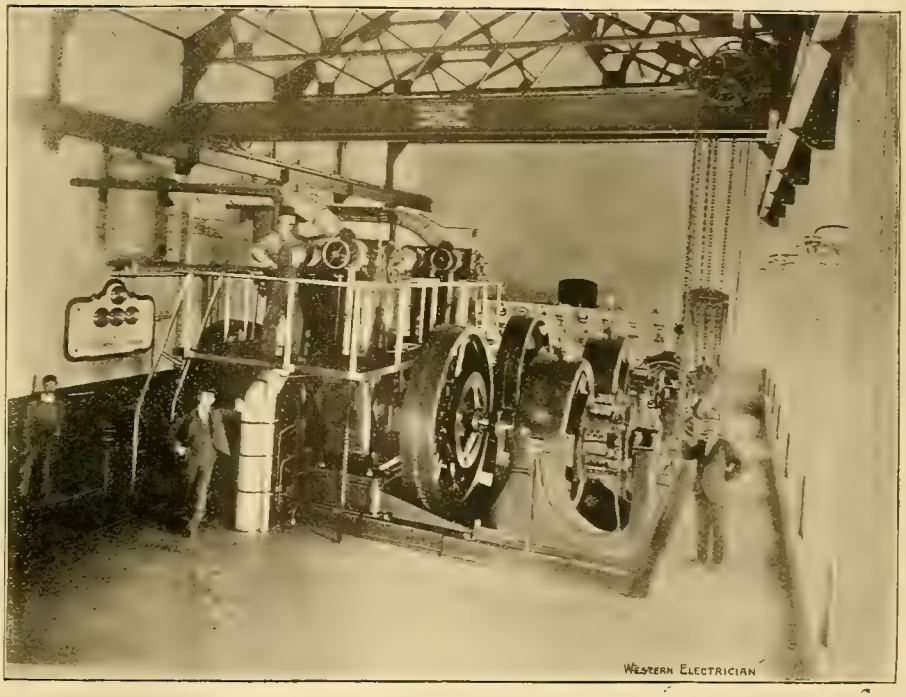


FIG. 3. INTERURBAN ELECTRIC RAILWAY.—ENGINE-DYNAMO EQUIPMENT.

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The scramble for public franchises in Cuba has already begun, and several applicants for electrical privileges have put in their bids for special favors. A combination of American and Canadian capitalists is seeking to control the street-railway lines of Havana, and it is claimed that a concession has been assured. One offer of $1,500,000 for the exclusive surface railway franchise is reported. Evidently capitalists have faith in the future of Cuba now that Spain has relinquished all claim on the island. The city of Havana is very scantily provided in the matter of street-railway facilities, and American manufacturers look to the establishment of a complete electric system with eagerness.

In spite of the added weight of the trolley cars and electric cables on Brooklyn bridge it is the opinion of Chief Engineer C. C. Martin that the structure is not weakened, and that there is no danger of serious "buckling" in the future. In a communication to Commissioner Shea Mr. Martin says that in his judgment "the bridge is as safe to-day as it ever was, and that is equivalent to saying that it is absolutely safe; that no one need entertain for a moment any fears of its stability." The most careful inspection and supervision by the engineering department of everything pertaining to the bridge has never been relaxed, he asserts, and moreover he promises that it will not be.

Restrictions regarding the running of trolley cars have been enforced with the aid of the police department, although Mr. Martin says that the surface railway and "L" companies have heartily co-operated with the bridge authorities in not only ensuring safety, but reassuring the public.

It will be remembered that Mr. Roebling's report pointed out danger in the policy of increasing the load on the bridge.

Public lighting furnished a subject of controversy in Berlin recently that ought to attract attention in this country. The municipal council determined to approve a contract between the municipality and several Berlin electrical works, according to which these firms and companies were to supply electricity to the city till the year 1915, while the municipality would participate to a considerable extent in the profits. A violent controversy has raged for some time around the question of the contract. The social democrats for once found themselves in agreement with the members of the rectionary party in advocating a municipal monopoly in electricity. Those who supported the companies were attacked as representatives of the worst form of "capitalism." The magistracy was accused of pusillanimity in declining to follow the example of much smaller towns in taking over the responsibility for electric lighting and power. The view ultimately prevailed, however, that inventions might place the capital value of the existing works and machinery in a doubtful position, and the contract was finally approved in the municipal council by 66 votes to 51. It is a significant fact that the companies are expected to pay the expense of experimental work, develop the industry and then when it reaches a stage of perfection where some adequate return might be enjoyed for the losses and risks involved, the goverment steps in and assumes direction of affairs.

The electric railway has made it necessary for the Canadian government to remove its observatory for meteorological service to Agincourt, several miles from Toronto. At present there is no electric railway within seven miles of the point selected, and little prospect of any within four or five miles for many years. The new observatory is divided into two parts. Stone piers were sunk to the depth of six feet below the floor and on these are placed the self-recording photographic instruments for recording the changes in the direction of the magnetic needle, and the instruments for registering respectively changes in the horizontal and vertical components of the earth's magnetism. Above this room and connected with it by a flight of steps is a structure which is divided into two portions. In the larger room, where the magnetic determinations will be made, piers have been provided on which to place the necessary instruments, with an adjustable opening on the roof for transit work. The small room is used for an office, and is heated by a copper stove. Great care was exercised in the selection of the material entering the structure and in the manner of construction. The government intends to prevent any encroachment upon this spot by electric railways, if possible.

The experience at Toronto, Washington and other points, where electric railway lines have disturbed the magnetic conditions and affected the instruments used in the observatories, has led students of terrestrial magnetism to seek new points free from these elements. One of the most important discoveries in this line must be credited to Prince Albert of Monaco, who, in the course of his studies of the Azores archipelago as a meteorological station for weather predictions, conceived the idea that any observatories established there might be of service to other branches of science, and more especially to terrestrial magnetism. The islands are situated near the important latitude of 38 deg. N. They are removed from all electric railways and other sources of disturbance, and their geographical position, intermediate between the old world and the new, furnishes a valuable link between the records taken in the eastern and the western hemispheres, respectively. The Portuguese government, upon recommendation of Prince Albert, consented to send Capt. Chaves, director of the meteorological observatory of Ponte Delgada, to Paris to study the arrangements at Parc Saint-Maur, and make a preliminary magnetic survey of the archipelago, with a view of fixing upon the most favorable situation for the combined magnetic and meteorological observatory. The new station is regarded as an extremely valuable acquisition to the observatories for terrestrial magnetism.

For the present at least the Chicago street-railway extension ordinances are disposed of. At the council meeting Monday evening the matter was referred to a committee composed almost entirely of aldermen who have been prominently identified with reform measures, and it is not probable that the street-railway interests will receive further consideration at the hands of the present council. The policy of Mayor Harrison not to consider any ordinance for the relief of the railway companies until the Allen law is repealed seems to meet with general favor, and it is probable that an attempt will be made at the next session of the Legislature to remove the obnoxious statute. For the first time in many years the street-railway corporations of Chicago are confronted with a city administration that is bitterly opposed to their plans for extensions and improvements. Those who have closely watched the trend of public opinion have anticipated this change for some time, but it is safe to say that they were not prepared for the rapid development of the opposition that has taken place during the last few weeks. When the street-railway ordinances were introduced in the council a month ago the "opposition" was referred to as the minority, but at Monday evening's meeting the mayor's following included a good working majority of the council. The change was brought about by the unmistakable evidence of public opinion that was forced upon the attention of the aldermen through public meetings, business men's delegations and labor organizations. Political clubs of both parties joined in the fight against the street-railway companies, and in many parts of the city Republican and Democratic ward clubs passed joint resolutions urging aldermen to support the mayor. The controversy developed some very interesting features, and proved conclusively that the street-railway companies were not in public favor. Probably the lesson will prove valuable to these corporations.

It is hard to justify the action of the Naval Board of Construction which, by a vote of four to one, recently decided against the introduction of electrical appliances aboard warships beyond their present comprehensive use in the operation of auxiliary power. The matter was brought to the attention of the board on the proposition to extend the electrical appliances on the battleships Kearsarge and Kentucky to the battleships Ohio, Maine and Missouri, for which contracts were recently awarded, with increased use of electrical power. The idea was to operate and control practically all of the auxiliary appliances by electricity, leaving steam to furnish propulsion only. Already many of the uses to which steam was formerly applied have been abandoned in favor of electricity, with satisfactory results, and the explanation offered for the action of the board of construction that the growth of installation in that regard has been greater than the experience of officers and men in handling electrical appliances cannot be accepted. The same argument might be applied with equal force to any other part of the service, if the department was content to stand still and not attempt to keep up with the progress. Surely the engineering force of the navy will appreciate the position in which this order places it and endeavor to bring about a reconsideration. Mr. Weaver, in his excellent paper before the New York Electrical society last week, which is presented in this number, gives an interesting account of the work done by electrical apparatus during the war, and furnishes a strong argument for the further extension of the electrical service. The excuse that the electrical force of the navy is not large enough to keep up with the demand will not be accepted. The people demand that the highest point of efficiency obtainable be adopted as the standard for the American navy, and this can only be accomplished by the use of modern apparatus.

Electrical Development in Italy.

[Prepared for the Western Electrician by the Philadelphia Commercial Museum.]

Seemingly very little attention has been paid in this country to electrical operations in Italy, a country in which the utilization of this form of energy has acquired great popularity, both for lighting and traction, within a year or so.

The formation of companies to generate and transmit power, both for traffic and industrial purposes and to light whole cities and villages, has progressed rapidly. European capitalists evidently recognize there is money in the business. Apparently, Americans do not—outside of the United States.

It is worth noting the more recent developments along this line in the Italian kingdom.

Only a month or so ago representatives of leading financial institutions met in Vienna and formed a company for the development of electrical enterprises in Italy. The promoters included representatives of the Rothschilds in Vienna, the Hungarian Bank of Credit and Ganz of Budapest, the Austrian Institute of Credit and the Union Electrical society of Berlin, with its associates in the firm of Bleichroeder of Berlin. The capital was temporarily fixed at $400,000, with power to increase it to $600,000. The company will at once undertake the execution of electrical works at Tivoli, with a view to transmitting power to Rome, the electrical lighting of Bologna and the transmission of power to Cherasco.

A new agreement has been concluded between the municipality of Rome and the Anglo-Roman Illumination company for the supply of gas and electric lights for Rome. The company has secured contracts until June, 1928.

Under the new management the price has been reduced since July last from five cents (American) to 3 3-5 cents per cubic meter for municipal lighting, and from six cents to 4 1-5 cents per cubic meter for private consumers. The rate is to be reduced one-fifth of a cent in 1903, again in 1908, and again in 1913, for municipal lighting, but private consumers will have to pay the 4 1-5 cents rate until June, 1918, when the price is to be reduced to 3 4-5 cents.

The price for electric lighting is to be, for the municipality, six cents per hour for 14-ampere arc lights, as against eight cents hitherto; to be reduced after five years, one-fifth of a cent, and after 10 years, two-fifths of a cent. Incandescent light is to cost the municipality and private consumers 1 2-5 cents per hectowatt-hour, as against 2 1-5 cents hitherto, the price to be reduced one-tenth of a cent per hectowatt-hour in 10 years, and one-fifth of a cent per hectowatt-hour from July, 1918. The amount of electric energy sold in 1897 was 23,707,608 hectowatts, of which 9,003,275 were used for the electric roads.

The company has bound itself to establish, within the next 12 months, a fresh connection with the Tivoli works, by means of which an additional supply of energy of 1,500 horse power may be secured, but so as to be able to meet all requirements for illumination, street-car lines and industrial purposes, it proposes to arrange for energy amounting to 10,000 horse power. The system of electric traction, which is already extensively applied to the Roman streets, is being extended to all the lines of the town and suburbs.

The first electric road was opened in 1895, under a 25-years' concession, a privilege which was subsequently given to the other companies. The overhead system has been adopted, but it is not popular, and it is thought that other systems may be used.

In Milan there has just been formed the Italian society for the application of electricity, with a capital of $800,000, to acquire and operate central electric stations at Aquila, Pontedra and Chioggia.

In 1897 the Edison company at Milan introduced energy of 10,000 horse power, obtained from the river Adda, at Paderno, power which was developed by six turbines of 2,160 horse power each (with a seventh in reserve), and seven dynamos. Power was transmitted to Milan from Paderno, a distance of 20 miles, by the ordinary overhead wire. The turbines were built in Milan, and were the most powerful hitherto made in Europe. The surplus power is used for industrial purposes.

The Edison company agreed to operate the street-car lines on the basis of 7.60 cents per car-mile for each independent car, and 3.88 cents per car-mile for each trailer. The company pays the city a revenue of $900 a year for each mile of single line. The receipts are cashed by the municipality, and, after the deduction of the company's share and the amount due for rent, the remainder is divided at the ratio of 60 per cent. to the municipality and 40 per cent. to the company. The city of Milan makes a profit of $150,000 annually. There are 42 miles of single line, and 5,000,000 passengers were carried. The employes work 10 hours a day and get four holidays a month. The rate of fare is two cents from the center of the town to the suburbs; workmen travel at half fare during the morning and evening.

Milan is not only the capital of Lombardy, which, with a population of 4,000,000, is the richest district in the kingdom, but it is also a most extensive industrial and commercial center, owing to the concentration of railway communication with foreign countries.

During 1897 electric cars were introduced in Leghorn, superseding the old horse cars.

The development of electrical street-car lines in Genoa is in the hands of a large German company, the Allgemeine Elektricitaets Gesellschaft of Berlin, which is extending the systems. Electric lighting is being prosecuted also, mainly by the Genoese Electrical society.

An English firm of engineers last year obtained concessions for lighting Bordighera and Ventimiglia, on the Riviera di Ponente, with liberty to apply the system to domestic uses. It was to supply incandescent lights of eight candle power for 20 lire (lire, 19.3 cents) yearly. Other parties were granted concessions for electric street cars.

In San Remo, on the Riviera di Ponente, a cooperative company, with a capital of 100,000 lire, in shares of 100 lire, composed of hotelkeepers and property-owners, was established in 1897 to introduce electrical lighting. The system included 2,000 lamps and the work was done by an Italian firm, the machinery being obtained from Tosi of Leglano.

During the year there was also great development in every branch of electrical application in Turin, and a manufactory of instruments for the measurement of electric force was established at Ivrea, in Liguria.

In Naples the high price of petroleum furnished a strong impetus to electric lighting, which is now general in the streets, theaters, stores, offices and private houses. Adjacent towns which have water power are utilizing it to the same end.

The power is 110 volts, and the lamps used are German, made either by Schubert or the Allgemeine Elektricitaets Gesellschaft. These lamps are inferior in color, finish and in light-dispensing power to the American.

Capua, near Naples, is lighted from energy obtained from the river Volturno.

Ancona has 20 arc lamps on the principal streets and 75, besides 600 incandescent lamps, for domestic lighting. The price per hectowatt is 11 cents per hour for the arc lamps.

In Cava Dei Tirreni, an important town, the water power used to operate the flour mills and grind corn all day operates an electric plant all night. The small villages of Piedimonte d'Alife is lighted by the stream which runs the cotton factory. Amalfi, near Sorrento, on the Gulf of Naples, a popular town much favored by tourists in the winter season, which has large hotels and factories and is 17 miles from a railway, was not lighted in 1897, although there is an abundant water power available.

At Vicenza a company has been formed to establish a central station to light the small towns of Breganza and Sandrigo.

The provincial authorities of Bresia are negotiating with the Helios company of Ahrenfeld, Cologne, for the construction of several lines of electric street cars.

In Perugia a central electric-lighting and power plant is about to be erected by Siemens & Halske of Berlin.

Congressional Appropriations.

[Special correspondence of the Western Electrician.]

Washington, D. C., December 20.—The District appropriation bill carries with it the sum of $60,000 for existing electric arc lighting, necessary inspection and extension of present lines. The arc lights are to cost not more than 25 cents per night; they are to be lighted from 15 minutes after sunset to 45 minutes before sunrise, and are to be operated wholly by underground wires.

For electricians, etc., for telegraph and telephone service the sum of $11,520 is asked, and a similar sum is asked for the purchase of general supplies, including new batteries, poles, tools, insulators, etc., while $6,000 is asked for the purpose of placing wires of fire-alarm telegraph and police-telephone service underground in existing conduits.

Electrical Interests in Brazil.

[From the Philadelphia Record.]

The electrical goods trade of Brazil is growing by leaps and bounds, it being but a few years ago that electrical trains, lighting, power, etc., were unknown in any part of the country, and now almost every town and city within 300 miles of the coast is either lighted by electricity or has the project under consideration. Many of the mining companies and cotton-cloth mills throughout the interior have plants now in operation, supplying them with both light and power. Several of the large plants have come from England.

Arc and incandescent lamps, fittings, carbons, wire of all kinds, electric bells, batteries, electricians' tools and gloves, zincs, sal-ammoniac, etc., are in demand in the towns along the line of the Central railroad between Rio and Sao Paulo and Rio and Bello Horizonte, as these towns at present rely on the Rio merchants for their supplies.

Bello Horizonte, the new capital of the state of Minas Geraes, is a growing town of at present about 30,000 inhabitants, and is located right in the heart of the mining and cotton-mill district, and practically at the end of the main line of the Central railway. It is, therefore, in a position to supply not only the mining and cotton mill companies, but the towns of Sabara, Sete Lagoas, Curvello, Caethe, Curo Prete (the old capital), La Fayette and about ten other small towns on the line of the railroad between there and Juiz de Fora, that are lighted with electricity, with electrical goods.

At Juiz de Fora another electrical plant is installed, and here another agency would do well in supplying, not only Juiz de Fora and the adjoining town of Marianna Procopio, but also the towns on the lines of the West of Minas and Laopoldina railroads, which intersect the Central Railroad at Sitio and Areal, both near here.

Along the line from Pio to Sao Paulo are also many towns in which it might be advantageous to have agents. A competent salesman, familiar with the Portuguese language, traveling through this section, could do wonders in the way of securing orders and appointing responsible agents.

This may also be said of nearly all the interior cities, as attention so far has seemingly been paid only to the large cities on the coast, and even there not to the extent the trade possibilities are deserving of.

BOOK TABLE.

Commercial Cuba. By William J. Clark. New York: Charles Scribners' Sons. Price $4.00.

This volume is intended for business men, and the principal object is to present in concise form the data necessary for forming an intelligent idea of the country. A feature of the work is the illustrations, including eight maps, seven plans and forty full-page half-tones, representing scenes in Cuban life. An exceedingly valuable department is the commercial directory of the island which is included in the volume.

Mr. Clark has certainly succeeded in presenting in attractive form a valuable treatise on the outlook in Cuba. The characteristics of the people form an important factor in all commercial transactions, their customs and methods, or rather lack of method of doing business, requiring careful attention. Mr. Clark throws out some valuable hints in this connection that cannot fail to be of service to those intending to visit Cuba soon. The many invitations extended by the Spaniards and natives are not to be taken too seriously. They are not meant to be accepted, but are merely extended as a formality, much in the same manner as "regrets" are often sent in this country when the recipient of an invitation could not be induced under any circumstances to accept. A good deal of attention is given these little points, as they play a conspicuous part in the everyday life of the Spanish race.

The work is not only interesting, instructive and valuable as a book of reference, but it is highly creditable as a literary production and will occupy a prominent place among publications of its kind.

Matter, Energy, Force and Work. By Silas W. Holman. New York: The MacMillan company. Price $2.00.

The author describes this treatise as "a plain presentation of fundamental physical concepts and of the vortex-atom and other theories." It is intended chiefly for students and teachers in physics and chemistry and of natural sciences generally, although it is believed that engineers and members of other technical professions will find valuable assistance in the treatment of the subject. The work is divided into two parts, the first containing the subject-matter proper, and the second summarizing the chief theories of the nature of matter, energy and force. The author has not attempted to present anything in the nature of an historical work, but has confined himself to an expression of his individual views. The volume is dedicated to the Massachusetts Institute of Technology.

Outlines of Industrial Chemistry. By Frank Hall Thorp. New York: The MacMillan company. Price $3.50.

It would be difficult to select a subject in which greater commercial interests are involved than that treated in this volume. Prof. Thorp has wisely confined himself closely to the subject in hand, and he has found sufficient material in the more important industrial chemical processes to occupy the space allotted him. For the benefit of those desiring to continue the study beyond the point reached in this work, numerous references are furnished and hints are given that should prove valuable to those who contemplate such a course. The present work forms purely an elementary course, and in the arrangement and treatment of the subjects follows closely the practice in the Massachusetts Institute of Technology; in fact, it may be said to embody the plan followed in that school and contain the results of many years' experience in teaching in this branch.

COMMUNICATION.

Submarine Cables of the United States.

To the Editor of the Western Electrician:

In your issue of December 10th you spoke about a submarine cable laid by the Southwestern Telephone company from Galveston to Beaumont, which is 16,650 feet in length, and stated that it was the longest submarine cable in the United States. If you will allow me, I wish to correct that statement, as we laid, last year, a submarine cable from Owl's Head, Rockland, Me., to Vinalhaven, a total length of the cable of 39,011 feet. This cable, in connection with 14 miles of land line, connects the town of Vinalhaven with Rockland, Me. The cable consists of two copper conductors, each thoroughly insulated, packed and armored, and made by the Washburn & Moen Manufacturing company. The diameter was 1 1-16 inches. It has always been my impression that this was the longest submarine cable used for telephone purposes in this country. If there is a longer one, I would like to know it.

MAYNARD S. BIRD.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Competition for Boston.

[From the Boston correspondent of the Western Electrician.]

The Massachusetts Telephone and Telegraph company looms up like a giant before the surprised gaze of the Bell Telephone magnates this week. The pigmy, incorporated with a nominal capital of $10,000, which petitioned the Boston city government for the right to operate in that city, proves to be a concern with millionaires for its backers, and has a well defined purpose and a mission to perform. But it is not the project itself which excites the community so much as the list of sponsors that was brought to light when the petitioners were granted a hearing. This list includes Oakes Ames of the wealthy Ames family of Boston, State Treasurer E. P. Shaw, John Shepard, the millionaire head of the firm of Shepard, Norwell & Co., Francis W. Breed, the Lynn capitalist, Albert C. Titcomb of Newburyport, George A. Alden of Boston, D. L. Demmon of Boston, Benjamin Dickerman of Newton and Boston and W. H. Brewster of Boston. As far as can be learned, they are in earnest in their project, do not intend to play into the hands of the established telephone company, although it was insinuated at the hearing that such was their purpose, and will go ahead with their enterprise at the earliest opportunity.

The hearing on the petition of "Z. S. Holbrook and others," representing the company, was assigned for December 8th. The matter had assumed a semi-political character at the meeting of the aldermen when first presented to that body, because of the approaching election and the opportunity afforded a number of the candidates for re-election to pose as the champions of the people and the city and also as opponents of telephone monopoly. On the other hand, there were enough members of conservative proclivities to check hasty action, and an attempt to railroad the petition through was sidetracked. Few of the members and very few people in the community realized at the time how large a project had been sprung upon them, and it was not until the hearing that they became fully apprised of its significance. Samuel J. Elder, a prominent corporation lawyer, and Judge E. C. Gilman appeared for the petitioners. Samuel F. Powers, counsel for the New England Telephone and Telegraph company, the local Bell concern, represented the present Boston telephone system, while Treasurer James D. Leatherbee appeared for the National Telephone Construction company, and Boardman Hall and G. D. Allen represented other interests, who opposed the granting of the franchise.

The disclosure of the backing that the petitioners had for the tiny company with only $10,000 capital cleared the atmosphere considerably. Judge Gilman introduced the capitalists through the medium of a brief manifesto, on behalf of the petitioners. It read as follows: "We, the undersigned, inhabitants of Massachusetts, and having a usual place of business in the city of Boston, are in favor of the Massachusetts Telephone and Telegraph company, and believe it will be for the interests, not only of the municipality of Boston, but also of the people and citizens of Massachusetts, that this company should be granted a franchise in the streets of Boston, as prayed for, and we join in the petition of Z. S. Holbrook and others, and in case the franchise is granted we will join with the petitioners in the organization of said company."

Mr. Gilman, in presenting this document, said that there seemed to be some misapprehension regarding the good faith and financial standing of the new corporation. The names appended to the statement, he believed, were sufficient guaranty of both. When asked why the capitalization had been placed at the small sum of $10,000, he replied that, for all purposes, this amount was sufficient until they secured the franchise. If that should be obtained, there would be capital enough forthcoming.

"What system do you propose using?" asked one of the aldermen.

"It would not be good business judgment for us to announce that," Mr. Gilman replied, "for it would place us in the power of the manufacturing concern. It will be such as we consider the best."

Mr. Gilman said that he did not know whether any of the names in the petition were those of stockholders in the Bell company, but he did know that if the petition were granted, these men would all become officers in the new company. He understood that the capital stock would be raised to $2,000,000 or $3,000,000, if necessary, and that they were not entering the field to antagonize other companies, but to give cheaper rates for a satisfactory service. It was proposed to put the wires underground and give the city a free service, for which it is now paying $32,000. The business community would have its telephone service for $72 annually. There are several companies in the country now serving the public wholly independent of the Bell patents, and they did not need to come under that company's jurisdiction to give a satisfactory service. There was no intention of selling out. The promoters were in the project to compete with the existing company.

The attorney for the New England Telephone and Telegraph company said that the order proposed would give, if granted, more to this company in the way of franchises than his company had been able to obtain in 20 years. "These gentlemen propose to furnish telephone service for less than the labor costs us," he said. "We can buy material as cheap as they can," he added, "but it costs 50 per cent. of the gross receipts for labor, exclusive of the salaries of officers, and it is impossible to reduce rates and earn a fair profit. About 12,000 subscribers are cared for in Boston alone, and in city and suburbs there are from 19,000 to 20,000 subscribers. It is part of a great national system, the greatest in the world. The system in Boston was built up by Massachusetts capital and Massachusetts men, however, and aims to furnish good service. There is no city in the country where the development has been so rapid as it has been in Boston, which has one subscriber to every 40 persons, in the city proper." If the aldermen felt that the company could do what it promised to do, however, and decided to grant it a franchise, the New England company would have to meet it as a rival or consolidate with it, he said in conclusion.

Treasurer Leatherbee of the National Telephone Construction company characterized the new concern as "simply a tentacle of the great octopus," organized to defeat genuine competition after the expiration of existing patents, and warned the aldermen to look out for "the cloven hoof," and at least go slowly in the matter of granting the petition.

The hearing produced a visible effect upon the aldermen, especially when the names of the additional petitioners came out. These representative business men seemed to be sufficient to settle any doubts that might have existed regarding the substantial character of the new concern. When the aldermen met on Monday, December 12th, therefore, debate was brief, and the vote in favor of granting the new company the franchise asked for was unanimous. Some perfecting amendments were made, and the board then passed the order, with its provisions, practically as follows:

That permission be granted to the Massachusetts Telephone and Telegraph company to forthwith construct, operate and maintain an underground system for transmitting messages and other intelligence by telephone and telegraph, and to dig up and open the ground in any of the streets, lanes and highways of the city of Boston, the work to be done at such times and places and in such manner as the superintendent of streets shall direct. The order and all rights granted thereby shall be wholly void if the company shall fail to establish, construct and equip an underground system, without poles or wires overhead, within a reasonable time from the passage of the order, with a telephone exchange in full operation; or if it shall fail to furnish to any applicant in the city of Boston, within a reasonable time, efficient telephone service, not limited as to the number of calls; or if it shall, in any event, either directly or indirectly, exceed the maximum charge of $6 per month for any business house, office or residence. This grant is made upon condition that the Massachusetts Telephone and Telegraph company shall execute some binding agreement satisfactory to the mayor of Boston that it will furnish free telephone service to the city and hold the city free from liability for damage claims arising under the franchise, and that it will not sell or dispose of the franchise to any other persons or corporations, reserving the right to license telephones and sell its stock by subscription, as any other corporation, and shall also satisfy the mayor that the company has financial resources which will enable it to carry out its agreements and execute the required bonds.

Assessment of Toronto Telephone Exchange.

[Special correspondence of the Western Electrician.]

Toronto, December 17.—The three county judges who have been hearing the appeal of the Bell Telephone company from the assessment as fixed by the city of Toronto have given judgment favorable to the company to the extent of over half a million dollars. The assessment on land and buildings was not touched, but that of $377,992 on poles, wires and conduits was reduced to $32,750; that of $177,174 on one switchboard was cut to $12,000 and on two others from $50,733 to $3,900. This reduction was made because the company claimed and the judges decided that the material should be assessed, not as a system in operation, but as separate parts, for what they would bring if they were taken away and sold.

Telephone Litigation.

A lineman named Harry Staats, employed by the Logansport Telephone Manufacturing company of Logansport, Ind., was instructed, together with another lineman, to take down a pole. They went together and dug a trench to let the pole down in, and Staats then went up the pole to attach a rope to guide the pole down. When the pole started to fall, Staats thought it was going to fall to the ground, and, despite the warnings from the other lineman, to stick to the pole and not jump, as it would fall only a little ways, Staats jumped and broke his ankle. Staats sued the telephone company for $7,000 damages. The judge instructed the jury to find for the defendant and then the counsel for the plaintiff dismissed the case. The judge held that it was contributory negligence on the part of Staats, and that he was of sound mind and eyesight and possessed all his senses, and that he used his own judgment when he went up the pole. This is the second case that the Logansport Mutual Telephone company has won lately. The other was a case where Rufus Magee, who owned a business block on a main street in Logansport, brought suit against E. B. Overshiner for $1,000 damages and ejectment of a pole that stood in front of his place of business. This case was taken to the Supreme Court, which held that the pole was not an additional burden to the property-owner, and that when the defendant secured a franchise from the city that it gave him the right to set poles in the street and in front of property for the purpose of completing the telephone plant for which the franchise was granted.

Extensions and Improvements.

A new telephone line will be constructed, connecting Clarksville, Tenn., with Rudolphtown. The movement has been on foot for some time, and arrangements for carrying it into effect have just been completed by Watson & Rudolph of Rudolphtown.

The Slate Belt Telephone and Telegraph company has commenced reconstructing its lines for metallic circuits. Over $10,000 will be expended on construction and improvements. New metallic switchboards will be placed in the exchanges at Nazareth, Bangor, Pen Argyl and Wind Gap, Pa.

The Metropolis (Ill.) telephone exchange has just been sold to Chamblin & Heustis of Robinson, Ill. The exchange is to be put in first-class shape. C. W. Chamblin will be general manager. The same firm has an exchange at Robinson, Ill. It has been rebuilt and is considered a model exchange.

Terre Haute is now connected by telephone with every town in that part of Indiana. The connecting line from Clinton to Terre Haute is completed and open for business. W. P. Ijams, Colonel John Beggs, A. M. Higgins, Sam R. Hamill, Harry Beggs, Charles Duffin of Terre Haute, and A. L. Millard of Chicago constructed the connecting line.

The Kansas Telephone and Electrical company is building a telephone line into Cherryvale. This company is composed of St. Louis people, and the system when ready will connect with 40 towns and cities, including the lead and coal district in Eastern Kansas and Southwest Missouri, Pittsburg, Joplin, Fort Scott, Carthage, Webb City, Galena, etc. The company now has an exchange in Parsons with over 300 subscribers.

The telegraph lines discontinued last spring by the Postal Telegraph company in Kentucky, when it transferred its wires to the right-of-way of the Illinois Central railroad, have been purchased by the Ohio Valley Telephone company, and they will be immediately re-equipped with a copper metallic circuit through Jefferson, Hardin and Bullitt counties, and telephone stations established at several points along the line.

The Delaware and Atlantic Telegraph and Telephone company is making preparations to occupy its new building in Wilmington January 1st. All of the inside work has been completed and the building has been put in good shape. The telephone line to Dover has been renewed and is in first-class condition, and a system of telephones has been established in the town. Although there is no extension below Dover, the company contemplates running the line to Lewes and passing through the more important towns between Dover and that place. It is probable that exchanges will be established at Middletown and Smyrna.

An independent telephone company has been formed at Wilkesbarre, Pa., and it is expected that it will have its exchange in operation early in the summer. Already 1,073 subscribers have been secured in Wilkesbarre and vicinity, and those interested say that the project will be a success from the start. The lines will reach Pittston, Nanticoke, Ashley, Plymouth, Kingston, Luzerne, Borough, Hazleton and all places in the county. In a short time it is expected that the company will be able to secure rights and construct a system for Lackawanna County, and then the two will be connected. E. S. Wayland is the manager of the company.

The Southern States Telephone company of Norfolk, Va., has just completed the private telephone system for the Norfolk and Portsmouth Belt Line Railroad company. Switching attachments have been put in the superintendent's office, which enable any station on the Belt line to be switched on any line of the Southern States Telephone company. The drawbridge keeper also has direct telephone connections. A telephone has been installed in the keeper's house, which is on a revolving tower 50 feet high on the center of the drawbridge. The wires are so arranged that turning the draw for passing ships does not interfere with the service. Much credit is due Superintendent William Pannill and his assistants, William Cole and Yank Miller, for designing and building for this company the plant.

The Standard Telephone company has bought all the lines and equipment of the Central Missouri Telephone company and has assumed control of the system. This new purchase gives the Standard company about 1,000 miles of lines in Missouri, and when all the connections are made it will give Kansas City communication with 150 Missouri towns. The Central Missouri system started at Versailles and ran north to Tipton, Boonville, Fayette and Moberly. From Moberly it ran to Mexico and Brunswick. It also connected Moberly with Macon, Gallatin and Trenton. The Standard company has adopted a plan very much on the order of that used by telegraph companies. In case someone wished to telephone to a town on its line and the wire was in use, it permitted a message of 20

words to be written and sent by the operator at the same rate that a telegram of 10 words would cost.

The Phœnix Telephone company of New York has appointed John W. Brooks, Monadnock building, Chicago, its western sales manager. Mr. Brooks has had an extensive experience in the electrical field in the West. For a number of years he was a partner in one of the largest supply houses in California, and early last spring he came to Chicago with the purpose of making this city his headquarters. The Phœnix company has appointed Mr. Brooks with the idea of inaugurating an aggressive western policy in competition with telephone manufacturers in the Chicago territory. It is safe to say that with a man of Mr. Brooks' experience in the field in charge of this department of the business, the Phœnix business will prosper.

Perfect Protection Required.

In an action to recover damages for personal injuries against an electric-light company, brought by a lineman employed by a telephone company, it was shown that the wires of the telephone company and those of the electric-light company were both strung along arms which had been nailed to poles on the same side of the street, with the poles of each company alternating; that the wires of the electric-light company were put up subsequently to those of the telephone company, and were about 12 or 15 inches lower; that this lineman was engaged with a force of workmen, under a foreman of the telephone company, in passing a guy or stay wire from the top of the telephone poles to a stay pole across the street on the opposite side; that it was the duty of the lineman to fasten his end of the wire to the top of the pole; that he had succeeded in getting the wire, which consisted of three strands, in proper position, and had about completed his task when he received the shock and injuries complained of, the proof tending to support his contention that the guy line came into contact, momentarily, with the outside line of the electric-light company, which, at that time, was carrying over 2,000 volts of electricity.

Evidence was also presented which tended to show that there is no such thing as perfect insulation of a wire of the size of the one in question, when transmitting currents at high voltages, though the evidence also conduced to show that the insulation used by the electric-light company at the point of the accident was not the best employed by it, as its own witnesses testified that it used a rubber insulation around awnings, windows and places where wires are likely to come into contact with some object, which was much safer than the insulation employed at the point where the accident occurred.

The trial resulted in a verdict for the electric-light company, but the Court of Appeals of Kentucky had some views of its own on this subject, in accordance with which it reversed the judgment, October 18, 1898, on the lineman's appeal. (Overali vs. Louisville Electric Light company.)

At the time the plaintiff was struck, the Court of Appeals says, the lineman was in a place where his business required him to be, and where he had a right to be, and it was the duty of the electric-light company to know that linemen of the telephone company would have to come into close proximity to its wires in attending to their duties, and that it was its duty to use every protection which was accessible to insulate its wires at that point, and at all points where people have a right to go for business or pleasure, and to use the utmost care to keep them so, and for personal injuries resulting from its failure in that regard it is liable in damages.

"Electricity," continues the court, "is the most powerful and dangerous element known to science. It cannot be seen, and it is as silent as it is deadly, and it follows that those who manufacture and use it for private advantage must do so at their peril. The only way to prevent accidents where a deadly current is used is to have perfect protection at those points where people are liable to come into contact with it." The jury in this case should have been instructed, declares the court, that this was the duty of the electric-light company. To have told them "that it was the duty of defendant to observe the highest degree of care and skill usually exercised by prudent persons engaged in the same or similar business to keep its wires so insulated as to be reasonably safe and free from danger to persons who might come into contact with them," was not sufficient. "The law requires," the court holds, "at those points where such contact is likely to take place, perfect protection from this unseen and terrible power."

Telephony Abroad.

The controversy between the National Telephone company, the English government and the municipalities desiring to engage in telephone business has reached the point where the company has assumed the aggressive and taken steps to prevent the municipalities and rival companies from purchasing apparatus. Sir James Marwick, town clerk for Glasgow, has been notified by two concerns that they would have to withdraw proposals for furnishing switchboards for the proposed municipal exchange. One of these says: "L. M. Ericsson & Co., the manufacturers of telephone apparatus at Stockholm, have officially informed me that they have entered into an agreement with the National Telephone company not to supply any telephone apparatus for exchange purposes to any municipality or corporation within the British Isles or any licensee of her majesty's postmaster-general, and that any orders must be accompanied by an agreement that the would-be purchaser will not sell, let, lend or dispose of to, or suffer or permit to be used by, any such municipality, corporation or licensee." The action of the National company in preventing the use of English and European switchboards in competition with its service may lead to the introduction of apparatus manufactured by the independent telephone manufacturing companies of this country.

The directors of the National Telephone company have decided to make a further issue of £330,000 debenture stock, forming part of a total limited to £2,000,000 (of which £1,339,471 has been issued), and to offer it in the first instance to the shareholders and debenture stockholders at par. The stock is a first charge on the entire undertaking, and is irredeemable except in the event of the government acquiring the plant, when it can be redeemed at 103 per cent. The net revenue for the year to June 30th last is reported to have been £369,007, and the amount required for the annual interest on the issued stock (including the present amount) is £58,431. It is anticipated that the net revenue for the year will show a considerable increase over the figures given.

Independent Telephone Movement.

[From the Chicago Record.]

Occasionally the people of Chicago are reminded that elsewhere an earnest effort is being made to break the power of the old telephone monopoly, although that institution is as formidable in this city to-day as at any period in its history. While the local Bell company is complacently increasing the rates for those who cannot tolerate the defective service provided by the antiquated "ground-return" system, and are therefore compelled to pay an additional fee of $50 for complete metallic-circuit instruments, the Bell interests at other points are confronted by determined opposition.

It cannot now be said that the independent movement is confined to small places, for companies have been organized and service is being given in many large cities. In St. Louis, for instance, the Kinloch company has more paid subscribers on its list than the Bell company has ever had in that city, and the Kinloch company has only recently completed its system. The new service is pronounced satisfactory in every respect and the rental is only $60 per year. A similar system is now being introduced into Indianapolis, and Cleveland is working along similar lines. Detroit has long had an independent company which outranks the Bell concern in importance, and other towns have found the independent service far preferable to the old order. In New York the Board of Trade and Transportation, which has been fighting the Bell monopoly for years, has pledged its support to an independent company. Boston has just granted a franchise to an anti-Bell corporation which agrees to furnish first-class service at a maximum rental of $72 per year. It is claimed by conservative telephone experts that $75 per year would be a fair rental for modern telephone service in Chicago.

The main objection to the establishment of independent telephone exchanges, especially in large business centers, is the annoyance and confusion created by a multiplicity of systems. Many of the most earnest opponents of the present arrangement hesitate about introducing a new factor in the form of an independent company into the already complicated problem. They contend that the telephone is a natural monopoly and that the public can best be served where only one system is operated, provided, of course, the monopoly is enjoyed under proper regulations and restrictions. The ideal plan would be to have all the telephone and telegraph service of the country controlled by the government, just the same as the mail service is now conducted. This was the original plan in England, and that country has been regretting the action of the postoffice authorities ever since it permitted the telephone business to pass into the control of private companies.

On the other hand, it must be admitted that the experience of American cities thus far does not confirm the fears expressed by the friends of the Bell company at the inception of the independent movement. Wherever opposition to the old monopoly has created a real demand for competition the problem has been solved satisfactorily and expeditiously, so far as the public is concerned. In such cases the Bell company has simply been eliminated from the problem. Its old subscribers have transferred their patronage to the new concern, and generally speaking that has closed the career of the Bell interests in that community.

It would be too much to expect a similar settlement in the case of Chicago, New York or other large cities. The greater the interests involved the greater the conflict and the more disastrous the results to those engaged in it, but the public cannot concern itself about any corporation like the Bell company, whose inordinate greed leads it to violate openly the terms of the franchise under which it is operating.

American cities may boast of enterprise and advancement in other lines, but wherever the Bell company controls the telephone service they must be content to play a secondary part. Think of the city of Stockholm having as many telephones in use as the city of Chicago! In Stockholm, with 250,000 inhabitants, there were 12,000 telephones in actual service in 1894. The Chicago Telephone company to-day has only 16,300 instruments in service, including all its suburban and out-of-town connections, and a liberal estimate of the actual number within the city could scarcely exceed 12,000—a significant showing, truly.

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

William F. Griffin has been placed in charge of the telephone system at Grafton, N. D.

The Elgin Telephone company is building a line between Elgin, Minn., and Plainview. It will be equipped with Bell instruments.

The Northwestern Telephone Exchange company has evacuated Amboy, Minn., because the council refused permission to set poles on Main street.

The Dakota Central Telephone company will extend its toll lines to Pierre, S. D., at once, if given sufficient encouragement. If not, the lines will stop at Highmore for the winter.

The Aberdeen telephone exchange is about ready for operating at Aberdeen, Wash.

The Forman Telephone company has reached Hankinson, N. D., with its toll lines. In the spring it will be extended to Wahpeton, N. D.

The Minnesota Central Telephone company has reached Grantsburg, Wis., with its wires, and will soon complete connection with the Twin cities.

Joseph T. West, chief clerk of the Helena office of the Rocky Mountain Bell Telephone company, committed suicide by taking opium and then turning on the gas. Despondency and ill health were the causes.

The court has refused to dissolve the injunction forbidding the Wisconsin Telephone company to erect poles at Marshfield, Wis.

Duluth, Minn., will take bids until January 20th for a franchise for a telephone exchange. The successful bidder will have to agree to a percentage of the gross earnings going to the city, and regulation of rates, free connection with Superior and other things. The local company's franchise will expire soon, and from the improvements it is making the indications are that it will make a strong bid for the privilege.

P. J. Menard of Sheboygan, Wis., contemplates establishing a telephone exchange at Manitowoc, Wis. Mr. Menard was formerly local manager for the Wisconsin Telephone company at Sheboygan.

The Litchfield Telephone company of Litchfield, Minn., is building a line to Manannah, Minn., and contemplates one to Forest City.

The Citizens' Telephone company of Mankato, Minn., has begun operations, with nearly 100 instruments in use. The remaining 100 will be connected as rapidly as possible.

The mayor of Racine, Wis., refuses to sign the resolution of the council ordering the Wisconsin Telephone company to take down its wires and substitute an aerial cable, for the reason that the ordinance does not specify when it shall become effective.

The Board of Education of Chippewa Falls, Wis., contemplates putting in telephones for all the ward school buildings.

The Iowa and Nebraska Telephone company has extended its wires north, to make connection at Worthington, Minn.

The Iowa Telephone company has increased its force at Carroll, Ia., owing to increased business.

Telephone connection has been completed between Pleasantville, Ia., and Sandyville.

Joseph Baker, a lineman for the Iowa Telephone company at Fort Madison, Ia., fell from a pole and was seriously injured.

L. T. Thompson, a farmer of Center township, will put up a telephone line from his farm to Leland, Iowa.

The Iowa Telephone company is working to increase its business at New Hampton, Ia.

The Northwestern Telephone Exchange company has discontinued its connection with the local exchange at New Richland, Minn., and long-distance service in that town has to be made through the company's toll instrument. There is considerable complaint over the change.

The Fergus Telephone company of Fergus Falls, Minn., has decided to connect with every village in the vicinity. A line will be built to Wadena as soon as frost is out of the ground.

There was considerable competition at Mankato, Minn., between the Northwestern Telephone Exchange company and the Citizens' company as to which would get the county-office connections, but the former won.

The Standard Telephone company recently gave an "opening" day to celebrate the completion of its connection with La Crosse, Wis. Caledonia, Minn., subscribers had free service all day on the toll line.

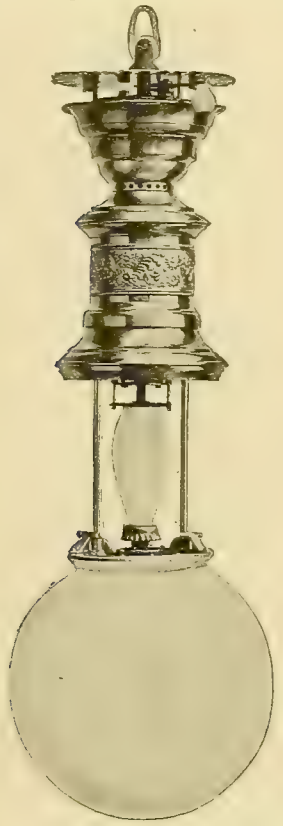
The Northwestern Telephone Exchange company has made a traffic agreement with the Fairmont Telephone company, both at Fairmont, Minn., and Heron Lake.

Sykeston, N. D., now connects with other towns of the county.

The Northwestern Telephone Exchange company has made marked improvement in the line between Zumbrota, Minn., and Red Wing since getting control.

Jandus Continuous Globe Lamp.

Attention is called to a new design of Jandus enclosed arc lamp which has several novel features, including continuous globe surface below the arc, ready accessibility to mechanism and rigidity of globe in lowered position, and as there is no lower



JANDUS CONTINUOUS GLOBE LAMP.

external globe support, the surface of the globe is made continuous, thus obviating any shadow and affording an attractive design. The globe is lowered for trimming by a slight upward pressure with one hand and a turn to the left. This unlocks a special device and permits the globe to slide down to the position shown in the cut. The outer globe is securely fastened to a ring or collar, which is maintained in a horizontal plane in any position and holds the globe in rigid relation to the lamp structure. The inner globe and lower carbon can be very quickly and easily removed for cleaning and retrimming. To restore the outer globe to its normal position, it is simply raised or shoved upward with one hand. When at the proper point it turns by torsion of the side rods firmly into a locking device.

The case, by a slight turn, can be dropped to expose the working parts of the structure, which are of the regular Jandus "25-inch" type. The lamp is exploited by the Jandus Electric company of Cleveland.

"Provo" Insulator.

The Hemingray Glass company of Covington, Ky., is placing on the market the "Provo" type insulator for high-potential work, which has given such excellent results on the 40,000-volt plant of

"PROVO" INSULATOR.

the Telluride Power Transmission company in Utah. The insulator was perfected nearly a year and a half ago, and is the outcome of several years of experiment, with existing types and many new forms.

It is all glass, which is the cheapest insulating material and, according to the makers, is the only one that is absolutely reliable when exposed to the weather and the action of high-potential currents.

It is 5¾ inches high and seven inches in diameter and has five petticoats. Two of these petticoats are near the line wire and serve to break the continuity of the exposed surface between the wire and the pin of the cross-arm, which tends to prevent jumping of the current between these points. Another advantage of these petticoats near the line wire is that they protect surfaces of small area and high resistance, which check surface breakage at its source. It is noticed in actual practice that these surfaces remain free from moisture and snow. The other petticoats on the bottom extend the surface distance from the line wire to the pin to 16 inches.

The line wire is tied around the insulator in the topmost groove, which holds it well above the cross-arm. This method of tying has been adopted, as it is considered the best for use in a country where the strain on an insulator may be either up or down or sidewise.

The thickness of glass is well proportioned and the insulator is extra strong in resisting mechanical breakage or electrical punctures. Tests have been made between the points for the wire and the pin with voltages as high as 125,000, without puncturing the material. The thread is of standard size and 2½ inches long. The strain of the wire comes squarely on the pin. The glass is almost colorless and the insulator is not conspicuous on a pole line.

The name of Hemingray is a sufficient guarantee for good work in the glass-insulator line. The company has increased facilities for manufacturing this insulator and is prepared to fill orders on short notice.

American Electric Locomotives for Paris.

A contract has been obtained by the General Electric company to supply eight electric locomotives and other equipment for the tunnel of the Paris-Orleans railway in Paris. D. Mazenet, manager of the company's foreign department, says, according to the New York Sun, that the contract was won against the strongest competition from British and other European companies, the negotiations having extended over two years. It was not until after the French engineers came to this country and made a thorough examination of the company's experimental railway at Schenectady that the contract was secured. The system of transmission to be used is that of three-phase generators, having rotary converters changing to a direct current at 500 volts.

The General Electric company, some months ago, secured a contract to supply 28 electric locomotives to the new Central London Underground Railway company. A number of the locomotives have been built and are boxed and ready for shipment. According to Mr. Mazenet, the cause of the success of the American concern was that it was able to show the greater conclusive experience in locomotive building and actual electric-railway operation, the question of comparative cost being virtually eliminated.

CORRESPONDENCE.

New York Notes.

New York, December 19.—It now seems to be quite well settled that the men who control the New York Gas and Electric Light, Heat and Power company are William C. Whitney, Thomas Dolan, Thomas F. Ryan, W. L. Elkins, P. A. B. Widener, Anthony N. Brady and Roswell P. Flower. The new company has bought the Mount Morris Electric Light company, with the view, it is said, of combining its output with the surplus produced by the Metropolitan Street Railway company's electric-power plants. The company has bought the Empire Subway company for the purpose of distributing the combined surplus product to the public. The electricity will be sold to the public for all purposes —for power, for light and for heat. It is a part of the scheme to cheapen the present cost of electricity greatly. It is denied that the Edison Electric Illuminating company has been purchased by the new "$25,000,000 company." It is important to note that there is now no denial of the plan to sell to the general public some part of the electric power of the great generating plant of the Metropolitan Street Railway company. "Holland," the well-known New York correspondent of the Philadelphia Press, makes an interesting statement on the general subject. He says that the gas men admit that gas has had its day as an illuminating agent, but that, naturally, they do not propose to yield without a struggle the business of selling artificial light to Mr. Whitney's company, or to any other company, unless they are compelled to do so. Therefore, they are said to be attempting to solve the problem by themselves supplanting their own gas product by the electric current, making use of their established plants, mains and conduits for that purpose.

The Westinghouse Electric and Manufacturing company has secured a very large blanket contract from the Third Avenue Railroad company. It provides for the entire plant for the electrical equipment of the lines of the railway company and is said to involve the expenditure of between $5,000,000 and $6,000,000 for boilers, engines, generators, rotary and static transformers, switchboards, car equipments, etc. The power plant will be erected at Two-hundred-and-sixteenth street and will have, according to the present plan, a capacity of no less than 64,000 horse power. Edward Lauterbach, counsel for the Third Avenue company, says: "We have already begun work on a part of the system. We expect to have the Third Avenue line proper in operation by electricity by next spring, and to have the Forty-second-street crosstown line running by electricity in the summer. All the other lines will begin to undergo a change of motive power immediately after next summer, so that the entire system will be operated by electricity within about a year and a half from date." Mr. Lauterbach said that possibly his company might sell power for general purposes, like the Metropolitan company, but that, if that business was entered upon, it would be quite distinct from that of the New York Gas and Electric Light, Heat and Power company, which seems to be closely allied with the Metropolitan Street Railway company.

Richard Croker has come out for the tunnel scheme of rapid transit, but with the proviso that the system be built and operated by private capital. The Rapid Transit Commission, as everybody knows, has devoted years to the work of formulating an underground scheme of rapid transit, but Tammany was never friendly to it. Now Mr. Croker has light to approve of the tunnel scheme, but he says the city must not be bonded for it. Under the law the commissioners cannot sanction the building of the road by private capital, but Mr. Croker wants the law changed. The commissioners also desire an amendment to the law giving them the right to either issue New York County bonds or enlist private capital as may prove best. While thus at variance, the Rapid Transit Board and Mr. Croker are nearer together than ever before. It is said that the Metropolitan Street Railway company is willing to undertake the construction of the new road.

On Wednesday evening of last week there was an especially interesting meeting of the New York Electrical society, devoted to the electrical lessons of the late war. Colonel Eugene Griffin was the first speaker. He spoke strongly of the advisability of organizing a torpedo militia, made up of electricians, who could, in the event of war, protect our harbors at short notice with mines and torpedoes. Mr. F. W. Roller, late chief engineer U. S. S. Nashville, told of the electrical apparatus used on the warships. The range finders and electrical firing apparatus were not successes, he said, but the searchlight was the greatest success of the period, and, but for its use, most of Cervera's ships would probably have slipped out of Santiago harbor and reached Havana, in which case the war might well be going on yet. The electric motor for turrets was also a great success, as was the system of incandescent lighting, whereby a warship can be almost totally darkened instantaneously. Mr. Roller read the paper of Lieutenant W. D. Weaver, editor of the American Electrician, late of the refrigerator ship Glacier, who was unable to be present. Captain Zalinski described the work of the dynamite cruiser Vesuvius.

M. S.

Northwestern Notations.

Minneapolis, December 19.—The council at Fargo, N. D., is considering bids for additional street lighting from the Gas and Electric company and also from the Hughes Electric company. The latter is a newcomer, and is especially desirous of getting the contract. The old company claims that its price, $10 per light per month, is a fair one, and invites comparison with other towns. The Hughes company offers lights at $5.

The council of Breckenridge, Minn., will buy a new 2,000-light dynamo.

The City Council has made an offer to the Water and Light company at Fergus Falls, Minn., of $45,000 for the plant.

The Electric Light and Power company of Glenwood, Ia., has put in a new engine and dynamo.

A peculiar accident occurred recently to the trolley poles on Hennepin avenue, between Third and Fifth streets, in Minneapolis. The cross-arms broke off at about 12:30 a. m. At that late hour but few cars were running and the trouble was remedied before morning. The cause is unknown.

Judge Gardner of Rapid City, S. D., has sold his interest in the Rapid City electric-light plant to Dr. E. J. Farlow.

The electric-light plant at Oconto, Wis., was burned out, with a loss of $60,000; insurance, $18,000. Arrangements are being made to rebuild. In the meantime a temporary service has been arranged for.

The Rapid Transit company at Waterloo, Ia., has placed a party car of modern fittings and equipment in its service.

There is a vigorous objection on the part of citizens in Des Moines, Ia., to the act of the council permitting the street-railway company to pave only five feet instead of seven, when the statutes call for the latter.

The contractors for the electric-light plant at Henderson, Minn., are endeavoring to force a settlement, but the council declines, as the plant is not satisfactory.

The council of Winnebago City, Minn., has let the contract to the Robinson & Cary company of St. Paul for a steam plant for the electric-light system.

Harry Sterling has been obliged to discontinue the electric-light plant at Huron, S. D. The plant was operated on artesian-well power for a while, but the well failed and had to be aided by a gasoline power, which soon failed to meet the demands.

Finally, a complete gasoline plant was put in, but the cost of operation exceeded the revenue. A steam plant is now contemplated, if the required backing can be secured.

George L. Carrington has resigned the management of the Electric Light company at Albert Lea, Minn., and is succeeded by E. A. Foot.

Mayville, N. D., citizens concluded, in a mass-meeting, not to grant a private company a franchise for electric lighting, but will secure information on the cost of installing and operating municipal plants.

The St. Paul Gas Light company was the lowest bidder for furnishing electric lighting for the city of St. Paul for the ensuing year.

The Cottonwood Coal company of Stockett, Mont., has completed an electric-light plant for lighting its offices and camp.

The Monmouth Merchant Mill at Mitchell, S. D., has just installed an electric-light plant of its own.

The street-lighting system in Sioux City, Ia., is gradually being changed and gasoline lamps are being replaced by 32 candle power incandescent lamps.

The City Council of Grand Forks, N. D., has accepted the new municipal electric-light plant.

The Murray Iron Works of Burlington, Ia., have the contract to furnish boilers and engines for a new electric-light plant at Jacksonville, Miss. The contract involves $10,000.

The electric-light plant at Lake Mills, Ia., has been increased by the addition of a 400-light dynamo and an 80 horse power engine.

The Board of Public Works at Des Moines, Ia., is preparing to consolidate the offices of electric-light inspector and city electrician, in the interest of economy.

F. McCormick of Duluth, Minn., will establish an electric-light plant at Olivia, Minn.

An electric railway is to be built from Harvard, Ill., to Geneva Lake, Wis. The Continental Construction company of Boston has offered to construct the line and have it in operation in June. It will handle both passenger and freight traffic.

The electric-light company at Appleton, Minn., petitioned the council to proceed under the law for the purchase of its plant. The council returned the petition on the plea that it was improperly drawn and did not contain enough signatures.

The council of Iowa City, Ia., is dissatisfied with the rates made by the local company for street lighting, and is securing information on the cost of operating municipal plants. There is talk of a new company entering the field.

Western Union officials were recently in Anaconda, Mont., on a tour of inspection.

Work has been begun on the municipal electric-light plant at Pierre, S. D.

The electric-light plant at New Paynesville, Minn., has been completed and put in operation.

The mayor of Winona, Minn., has vetoed the resolution of the council to add to the duties of the city engineer those of city electrician.

The enlargement of the electric-light plant at Rochester, Minn., has been completed.

A reorganization committee has been formed for the purchase of the Fox River Electric Railway company at Green Bay, Wis.

The owners of the electric-light plant at Colfax, Wash., contemplate removing it to Palouse, Wash.

Surveyors are running an extension of the electric line from St. Paul to White Bear, on to Stillwater, Minn. It is expected that it will be completed in the spring. S. P. M.

Canadian Intelligence.

Ottawa, December 19.—It is proposed to extend the Ottawa electric street railway to the town of Britannia, about eight miles from Ottawa. The people along the route are endeavoring to bind the company to an agreement giving them city rates.

Notice is given on behalf of the Quebec, Montmorency and Charlevoix railway that application will be made at the next session of the Dominion Parliament for an act amending the act incorporating the railway, in the following particulars: To change the name of the company to the Quebec Railway, Light and Power company; to ratify the purchase of the property and franchise of the Quebec District Railway company by deed passed at Quebec, on June 29th, the issues of bonds and stock made for the purpose of paying the purchase price thereof, and to authorize the company to build a line of railway or tramways in the counties of Levis, Bellehasse, Dorchester, Beauce and Lothbiniere; to ratify the purchase of the property, works, plant, buildings, machinery and capital stock of the Montmorency Electric Power company and the issues of bonds and stock made by the Quebec, Montmorency and Charlevoix Railway company, in connection with the purchase.

Owing to the small number of tenders received by the City Council of Toronto, Ont., for the installation of a municipal electric-light plant, it has been decided to accept none of the tenders. From the tenders submitted it was found impossible to arrive at even an approximate cost of an electric plant. No tenders were received from Canadian manufacturers. In this connection the Anglo-American Electric and Supply company has made a proposition to supply electric energy to the city. Power is offered at cost, after paying a dividend of 10 per cent. to the shareholders upon a capital stock of $5,000,000. It is guaranteed that the cost to the public will not exceed one cent per horse power per hour.

J. George Gardner of Baltimore, Md., has been in Ottawa, with a view to ascertaining the commercial value of the experiments made in the manufacture of calcium carbide. He examined the carbide which he saw manufactured from the Emerson process, and, after experimenting with it, was pleased to discover that slag and other impurities were wholly absent from the carbide produced from sawdust. It is said that Mr. Gardner is empowered to purchase the product of Mr. Emerson's plant in case Ottawa, the most favorably situated location known in regard to natural and artificial conditions, will undertake the manufacture of this article of commerce.

The City Council of Toronto has requested the electric street-railway company to make a trial of various fenders, with a view to the adoption of the one found most efficient.

The largest electric-light dynamo in Canada has just been installed in the new power house of the Ottawa Electric company, near the suspension bridge at the Chaudiere Falls. It is of the Westinghouse type with a capacity of 10,000 lights. The machine weighs 23 tons and is 15 feet in height. This dynamo will supply current for the lighting of the parliament and departmental buildings of Ottawa.

The south shore, at the Lachine Rapids, Quebec province, will soon be able to boast of hydraulic works, similar to those on the north shore of the Rapids, which belong to the Lachine Hydraulic and Power company. A company has been formed, composed of Canadian and New York capitalists. Work is expected to begin next spring, the promoters of the company intending to study during the coming winter the effect of the frazil ice in the chutes of the Lachine Power company dam. To create the required fall, the new company will have to dam Isle du Diable to the mainland, at the head of the Rapids, and lower, from the same island to Isle du Paquette. When once this new water power shall be created, the city of Montreal will then have another electric company to supply citizens with light and power for manufacturing purposes. Montreal will then have the advantage of several competitive electrical companies to select from.

The answer of the Cataract Power company to the city of Hamilton, Ont., to the City Council's request to state a price for power, also statements showing the number of lights used by the city, their cost and the saving to be effected by a civic plant, has been handed in. It is figured out on the basis of expert report, that the city can save $4,000 a year and have its own plant all paid for within 20 years. The Cataract Power company will be given until the 1st of February next to quote figures for power sufficient to operate a plant for 500 arc lights and 1,000 incandescent lights. Meanwhile all information gathered by the special committee will be laid before the City Council.

Owing to the detrimental effect of the electric current in the city of Toronto, the Dominion government found it necessary to move its observatory to Agincourt, nine miles from Toronto. At present there is no electric railway within seven miles of that point, and little prospect of any being built for years to come. The new observatory, which was finished last September, is divided into two parts. The circular cellar, 19 feet in diameter, is where the magnetic determinations will be made. Great care was taken in selecting materials for the building. Every stone used was tested for magnetic effect, and nothing but copper or zinc nails and fastenings have been used.

The City Council of Vancouver, B. C., is desirous of purchasing the electric railway, but a proposal to float the whole electric-railway system of the province of British Columbia into one syndicate in England, blocks the city's scheme.

Mr. Letheule, an electrical engineer of Paris, France, visited Quebec recently, in the interest of the French government, to examine and report on the application of electricity for industrial purposes.

Dr. C. J. Edgar, manager of the Eastern Townships Light and Power company, has concluded the purchase of the water power at Nengle's Dam, near Rock Forest, Quebec. The company intends to transmit electrical energy for power and lighting purposes to the city of Sherbrooke, Que.

The Ancaster, Ont., Township Council has passed a by-law to extend the Hamilton, Chedoke and Ancaster Electric Railway company's right-of-way on the highway for another term. The council also passed a by-law extending the time in which the company is to earn the township bonus of $5,000 to December, 1899.

Application will be made at the next session of Dominion Parliament for power to build and operate, by steam or electricity, a railway from Ottawa by way of Kingsmere to Meachs Lake, Que.: to construct branches to Hogs Back, Graham's Bay, Aylmer and Hull; to construct a railway, foot-passenger and vehicular bridge across the Ottawa River in the township of Nepean to the township of Hull.

Messrs. Nesbit, Gauld & Dickson of Hamilton, Ont., are applying to the Ontario Legislature for an act to incorporate the Hamilton and Caledonia Railway company. The idea of the promoters of the railway is to build a line from the city of Hamilton to Caledonia, and to extend it to the village of Selkirk. It will be an electric railway, if the project goes through. A. V. W.

PERSONAL.

The Hon. George O. Proctor, the president of the Anchor Electric company, of Boston, was elected mayor of Somerville by a very large majority at the recent municipal election.

George F. Card, the electrical engineer, and J. F. Card, superintendent of the Card Electric Works at Mansfield, O., have resigned their positions, and it is understood that they will devote their attention hereafter to the manufacture of an acetylene-gas machine of which G. F. Card is the inventor.

William F. Gardner, for 35 years connected with the Naval Observatory, died recently at his residence in Washington, at the age of 55. He was the inventor of the instruments for the transmission of time from the Naval Observatory by telegraph to all parts of the country, and of the synchronous clocks used in the executive departments.

Frank E. Colbert has been appointed western representative of the Electrical Review of New York. Mr. Colbert has an office at 965 Old Colony building, Chicago, which will be his headquarters. He has many friends in the electrical business in the West, particularly among street-railway men, who will be glad to extend him encouragement and assistance in his new venture.

Mr. Francis E. Drake, director of machinery and electricity of the United States commission to the Paris Exposition of 1900, is in the East arranging for the representation of American manufacturers in his department. Mr. Drake has received much encouragement from the leading builders of machinery and electrical apparatus, and he predicts that the American representation will be the crowning feature of the exposition.

Mr. F. W. Peck's nomination as commissioner-general to the Paris Exposition was not only confirmed unanimously last week, but the senators on the subcommittee which investigated the objections to his confirmation say they were unanimous in finding that these objections were not only unfounded, but were too trivial for consideration, even if true. Accordingly, Mr. Peck enters upon his duties feeling assured of support from the administration in his efforts to make the American exhibit at Paris truly representative in character and befitting the occasion.

John C. Barclay, for many years night manager of the Western Union Telegraph company's Chicago offices, has been promoted to the position of chief electrician of the western division, made vacant by the death of Charles H. Summers. Mr. Barclay has been in the service of the company 31 years, 20 of which have been spent in various capacities in connection with the Chicago offices. Beginning at 12 years of age, as check-boy in the offices of the company in Greensburg, Pa., he has gradually been advanced until now he holds one of the best positions in the gift of the company. Since becoming night manager, in 1887, Mr. Barclay has devoted much of his time to development of the press service, and to his energy much of its perfection may be ascribed.

Hillary Messimer, who died at Reading, Pa., December 16th, aged 65 years, was born at Pottstown, Pa., and had an interesting career as an engineer. About 1859 he entered the engineeer corps of the navy and served on the flagship Wabash during the naval engagement at Port Royal. He was the first man to go ashore after the capitulation of the forts. He was at one time shipmate with Dewey, Sampson and Watson. At the close of the war he was ordered to the Mediterranean squadron, and served there until 1868, when he entered the service of the Reading Railroad company. In 1882 he left the Reading company in order to take charge of the machinery of the mines operated by Coxe Bros. & Co. at Drifton, Pa., and the surrounding country. He held this place until 1887, when he resigned and went to Kansas City, Mo., to start the Kansas City Bolt and Nut Works. He remained there only two years, when he went to Calumet, Mich., as superintendent of motive power and machinery of the Calumet and Hecla Mining company. He held this place at the time of his death. In 1868 he was married to Miss Mary S. Laughlin of Pittsburg, who, with four children, survives him.

ELECTRIC LIGHTING.

The Hagerstown, Md., City Council on December 1st unanimously passed an ordinance to establish a municipal electric-light plant and to provide for the sale of $60,000 of bonds to pay for the plant. The present contract for lighting the town is with the Hagerstown Railway company. The city contends that the contract expires in two years, but the company claims it will run for seven years longer. Mayor E. M. Schindel has signed the ordinance.

An illuminated sign on an uptown store in New York spells the name of the proprietor in letters outlined by electric lights, and is lit up and then made dark again automatically. When the sign begins to shine out the electric lamps at the left are the first to appear, and then the illumination follows the course of an immense pen writing the name out. So closely is the course of the pen followed that the "i" in the name is not dotted with its especial electric-light dot until the last flourish at the extreme right of the name is lit up; then, with a perceptible

interval, as if the gigantic pen was being carried back, the dot on the "i" is made and shines out, and the whole name appears.

The Muncie, Ind., electric street-light plant power house was damaged to the amount of $3,000 by an explosion December 16th and Superintendent William Warner was badly injured. Mr. Warner was lighting the natural-gas fire under a boiler that had not been in use for some time. When the torch was applied there was an explosion of an accumulation of natural gas. The superintendent was hurled through a closed door, and it was feared that he was fatally burned.

The United States Electric Lighting company has filed its answer to the suit recently brought against it by its rival, the Potomac Electric Power company, for an injunction to enjoin the defendant from proceeding with the construction of certain conduits. The answer declares that in response to the expressed wish of Congress and the commissioners of the District it is the company's desire to have all overhead wires placed underground, and that it has purchased a large amount of material for this purpose.

Indianapolis is a well-lighted city, according to the Sentinel, and will compare favorably with the best municipalities in the country for lighting. When the management of the city came under the new charter some years ago the basis for lighting was fixed at 800 arc lights, but it was not long until this became inadequate and new lights were located at various points. The last bill which was rendered to the city by the Indianapolis Light and Power company for lighting specified 1,186 arc lights. The total amount for these lights was $8.270.41 for the last month, which would amount to the total of $99,-244.92 for the year on the same basis.

A judgment for $2,000 has been secured against Martin's Ferry, Ohio, by the Bridgeport Electric Light company. The suit was brought because of the destruction at the hands of the city's officers of the company's poles after it had been ordered to remove them. The Bridgeport company formerly furnished the city's street lights. A fire three years ago destroyed the plant and Martin's Ferry put in its own plant. The order to remove the poles followed, and the company brought suit, claiming practical franchises for a number of years subsequent to the destruction of its poles and claiming recompense for estimated loss occurring because of the destruction of its line.

Seymour, Ind., will receive proposals on February 9th for supplying the city an electric plant of sufficient capacity to furnish street lighting and supplying arc and incandescent lighting and power for private purposes. All machinery and lamps to be used in the construction of the plant must be entirely new. Proposals will be received at the same time for supplying the city with all-night arc street lighting for a term of five years from October 27, 1899. All bidders must attach a schedule of prices to be charged private consumers for both arc and incandescent lighting. The present service consists of 60 arc lamps for street lighting and incandescent lights for commercial purposes. The company's contract expires next October.

Boston claims the distinction of being not only a city of light intellectually, but materially, and it bases its claim on the fact that "it has a larger number of electric lamps for every 1,000 inhabitants than any other city in the world." The figures presented by the Boston Globe in support of this contention show that Boston has 373 more lamps per 1,000 than Greater New York, the record standing 1,232 to 859 in favor of the hub. Third in the list comes "boastful Chicago" with 730. Then follow San Francisco with 660, St. Louis with 660, Cincinnati with 551, Philadelphia with 375, Baltimore with 373, Brooklyn with 286, Vienna with 246, Edinburg with 242, Paris with 185, London with 184, Berlin with 178. And yet, it is admitted "there are dark places even in Boston of the illuminati."

The annual report to Congress from the superintendent of the library buildings and grounds at Washington shows that the grounds have been illuminated by electricity regularly throughout the year. Current for this purpose, together with the artificial light needed in some parts of the building on cloudy days and the power for the book-carrying and ventilating machines, has been supplied by the electrical apparatus within the building. Since October 1st the building has been open to the public on week days continuously from 9 a. m. until 10 p. m. Since that time the principal public spaces, including the whole of the staircase hall, the main reading room, congressional reading rooms, the two west corridors in the first story and the exhibitions in the west and south fronts, have been lighted after nightfall from the same electrical apparatus, including 3,600 lamps of different sizes, equivalent to 4,800 lamps of 16 candle power.

ELECTRIC RAILWAYS.

The negotiations that have been pending for some time for a suburban electric line from Louisville to Anchorage, Pewee Valley and probably Middletown are progressing successfully, and the route as far as Anchorage is now assured, with a strong possibility of its being continued to the other points mentioned. The right-of-way to Anchorage, with the exception of one mile, has been secured, and there will be little difficulty in securing the remaining part.

The Brooklyn Heights Railroad company is constructing five new trolley cars for the government for use in the postal service in that borough. Unlike the present combination postal cars, they will carry no passengers. They are 16 feet long and will each cost $3,000. The statement is made that the new cars will be owned and operated by the government.

An electric street-railway line is proposed from Terre Haute, Ind., west through the cities of Paris, Kansas, Charleston and Mattoon, a distance of 58 miles. Crawford Fairbanks is interested in the proposed line, and with him are associated W. R. Patton, W. J. Kenny and A. J. Fryor of Charleston, and John Hamilton, Joseph Montague and H. S. Clark of Mattoon, with a representative capital stock of $125,000.

The Jersey Grange Patrons of Husbandry have rejected a resolution requesting the Legislature to repeal the law prohibiting trolley-road cars from carrying freight. The law was passed two years ago, and last year the grange unanimously adopted a resolution asking for its repeal, and appointed a committee to make known its action to the Legislature, but the committee failed to perform its duty and the grange's action was not made known to the legislators.

Justice Collins of the Supreme Court at Trenton, N. J., has filed an opinion upholding the constitutionality of the "Squire" trolley law, under which the Elizabeth City Railroad company received a franchise to build an electric railway between Elizabeth and Plainfield. The company is controlled by ex-Congressman John Kean, who made the highest offer for the franchise. The law was attacked on the ground that it was special legislation, but the Supreme Court overruled every objection and the road will now be built.

The outlook for an electric line connecting Ottawa, Ill., Streator, La Salle and Peru is favorable. The granting of the franchise in Ottawa was delayed because of a feeling that the new road would operate strongly against the local line. Mr. Reeves has satisfactorily explained the purpose of the projectors of the road. They will build a well-equipped road connecting Ottawa, Streator, La Salle and Peru in the spring. All they asked of Ottawa is to grant them the privilege of entering Ottawa, through the South Side, crossing the Illinois River bridge and leaving the city on the West Side.

The Denver City cable railway was sold at auction December 15th by order of the United States Court under foreclosure of a mortgage for $4,000,000, the interest on which had been in default since 1892. H. E. Rogers as agent of Frederick P. Olcott of New York, chairman of the reorganization committee, secured the property for $500,000, the minimum bid allowed. The West End Electric railway was also sold under foreclosure, being purchased by the same company for $40,000. It is understood that ultimately the lines will pass into the hands of the Denver Tramway company.

The statement is made in St. Louis that stockholders of the Chicago and St. Louis Electric Railway company, which was organized six years ago to build an electric line from Chicago to St. Louis, are considering the best way to start an investigation of the affairs of the company. There is a strong disposition to take the inquiry into court and force an accounting. Stockholders have subscribed $112,000 in cash and most of this has been expended in preliminary work. Wellington Adams, chief promoter of the road, is reported to have said that there was little likelihood of the completion of the road.

The Newport News and Old Point Railway and Electric company has commenced suit against the city of Newport News for $20,000, and also against M. Honan & Sons, sewer contractors, for $20,000. This suit against the city, which is the first in the history of Newport News, and that against the men who contracted to put down a sewer system for $75,000, was the outcome of conditions brought about in laying the pipes in the East End parallel to the car line. The construction of the sewer necessitated, according to the views of the contractor, interruption of traffic on the road, and matters were fixed so that cars could not pass on the East End and passengers were obliged to walk half a square from car to car. The gist of the suit is "negligence, unskillfulness and unnecessary delay."

It is reported from Cleveland that an English syndicate is negotiating for the purchase of the Big and Little Consolidated street railways, the two companies which control and operate all the street-railway lines in that city, both cable and electric, as well as all the suburban lines in and about Cleveland. A fact that lends color to the report is that Henry Everett, formerly president of the Big Consolidated, is in New York, accompanied by C. W. Wasson and E. W. Moore, both of whom are interested in street-railway property. Mr. Everett is a heavy stockholder in the Big Consolidated lines, and recently has bought up large blocks of Little Consolidated stock, with the ostensible purpose of consolidating the two companies and making himself president of the combined organization. It is now stated that Mr. Everett has been working as the agent of an English syndicate. The street railways of Cleveland, together with the suburban lines, are capitalized at $24,300,000. It is estimated that the entire street-railway system can be purchased for about $35,000,000.

Steel poles, made in Pittsburg, will mark the 26-mile course of the city of Mexico electric railway now being constructed, and electric motors, made in the same city, will operate the cars. They will carry the wires supplying the electric current to the system. Between 1,700 and 1,800 of the poles have already been shipped to Mexico by the Pennsylvania Tube Works, and it is understood that three times that number will be required to complete the line. The poles are made of steel pipe and are 28 feet high. They will be placed at intervals of 100 feet between the city of Mexico and San Angel, a distance of 26 miles. Inside the gates of the city the side-pole system will be used. Outside the city the single-bracket plan will be in use. The first portion of the street-railway service which will be changed from horse to electricity will be the line to Guadaloupe, the oldest street-railway route in all Mexico. At about the same time the line to San Angel will be converted. This road runs by way of Chepultepec, Turenbaya and Mixcoac, and will cause the laying of about 26 miles of track. Work on the construction of the power house and other buildings is progressing rapidly. A large portion of the structural steel and iron is being made according to specifications by the Riter-Conley Manufacturing company of Pittsburg. Westinghouse motors will be used in all the cars.

TECHNICAL SCHOOLS.

The Edison Lamp company of Harrison, N. J., recently presented to Professor A. F. McKissick, for the department of electrical engineering of the Alabama Polytechnical Institute, a case containing the materials used in the manufacture of the Edison incandescent lamp, arranged to illustrate the process of the manufacture of the lamp. The several steps in the process of making the lamp are shown.

Two gifts were made to the electrical engineering department of Syracuse University last month. Lyman C. Smith of Syracuse, who is a member of the board of trustees, presented to Chancellor Day, for the electrical engineering department, a milling machine. It has over 2,000 combinations. It has been placed in the basement of the Steele Hall of Physics. A prominent citizen of Syracuse has presented to Chancellor Day $1,000 to purchase apparatus for the department. The faculty is striving to make the electrical engineering department one of the strongest and one of the finest equipped in the country. Much special apparatus has been added. The Straight Line Engine company has placed the base for the 40 horse power engine and for the direct-connected 30-kilowatt Onondaga dynamo. The department is now equipped with 10 dynamos and motors, an arc-light machine and a street-car motor.

PUBLICATIONS.

"The Perfect Sectional Conductor System" is the title of a neat pamphlet issued by the Safety Third Rail Electric company of New York, explaining the details of construction of the system invented by John McLeod Murphy. The Safety Third Rail Electric company of New York was incorporated under the laws of the state of New York for the purpose of purchasing the assets of the Safety Third Rail Electric company, organized under the laws of the state of New Jersey. The object of the new company is to exploit the system on a large commercial scale. A construction and manufacturing company is now in process of organization. This system is now being installed at Manhattan Beach, New York.

"New Era Gas Engines," an illustrated pamphlet issued by the New Era Iron Works company of Dayton, Ohio, gives some interesting information to purchasers of gas and gasoline engines. The company announces that it has within the last year built New Era engines of 125 horse power, which are the largest single-cylinder, four-cycle engines built in the United States. This engine takes care of occasional overloads, and compensates to a certain extent for the various qualities of fuel. The four-cycle engine, it is claimed, has proven to be reliable, durable and economical. The principle of heavy weight in the bed, and flywheels, with a sensitive governor, a properly constructed mixing chamber, with valves that will take an evenly mixed charge of gas and air, is utilized in the New Era by men who have been in the business from 10 to 30 years.

"Graphite" is the name of a new house organ. It is "issued in the interest of Dixon's graphite productions, and for the purpose of establishing a better understanding in regard to the different forms of graphite and their respective uses," by the Joseph Dixon Crucible company, Jersey City, N. J. The first number contains a carefully prepared article on graphite and some interesting statistics concerning its application to commercial use. It gives an interesting historical sketch of the development of

the industry from the beginning by Joseph Dixon in 1827. Lead pencils had been made long before, but from that date to the present time, Joseph Dixon and his successors have been active in promoting the uses of graphite in every conceivable way. At no time, especially since the incorporation of the Dixon company in 1868, has the enterprise, work or enthusiasm been permitted to lag.

"About Conduit Outlets," which explains in detail the Erickson system, is being distributed through the West by the Leschen-Macomber-Whyte company of Chicago, the representative of the Erickson Electric Equipment company of Boston. This little pamphlet is designed to call to the attention of the progressive element of the electrical fraternity the Erickson outlet devices, to be used in connection with the present generally-adopted conduit system for concealed wires. Junction devices now in vogue, it is claimed, afford but a minimum of protection to wires drawn over conduit ends, are expensive of application, and are entirely lacking in flexibility, while this outlet system, from its wide range of elasticity of application, its protection from abrasion of wires drawn over conduit ends, its economy and simplicity of installation, is bound to appeal to the contractor in search of the greatest efficiency at the least cost.

ELECTRICAL SECURITIES.

The International Bell Telephone company has declared a dividend of six per cent., payable January 4th.

The Westinghouse Electric and Manufacturing company has declared a quarterly dividend of 1¾ per cent. on its preferred stock, payable January 3d.

The Columbia Electrical company has filed in the county recorder's office at St. Joseph, Mo., a statement of increase of capital stock from $2,000 to $6,000. The assets of the company are given at $9,000 and the liabilities at $4,000.

The Lynn and Boston Railroad company, which operates between the two cities, reports gross earnings of $1,484,251 and operating expenses of $855,790. Charges, taxes and rentals leave a surplus of $107,561 net, cut of which $101,280 in dividends was paid.

Reports have been made and denied and reiterated that a New York syndicate, headed by H. B. Holland, a banker, is negotiating for the purchase of the Missouri-Edison Electric company, the figure offered being placed at $8,000,000. Missouri-Edison stock has advanced 10 points in the last week on the strength of these reports, and all the stock offered was quickly snapped up.

The Western Union Telegraph company has declared a quarterly dividend of 1¼ per cent., payable January 16th. The company reports for the present quarter the following estimate: Net revenue, $1,450,000; interest on bonds, $224,273; balance, $1,225,727; dividend, 1¼ per cent., $1,216,985; surplus, $8,742; previous surplus, $8,049,213; total surplus, $8,057,955. The business shows a decrease of $103,514 from that of the corresponding quarter of the previous year.

The Southern New England Telephone company has placed a mortgage of $1,000,000 with the New Haven Trust company, for the purpose of paying off the present mortgage on the company's property, for the perfection and extension of its line, and for its maintenance and operation. The property pledged is located in New Haven, Bridgeport and Waterbury, including land and buildings in these cities used by the corporation as exchanges.

The preferred and common stocks of the Otis Elevator company have been placed among the unlisted securities of the New York Stock Exchange. The consolidated company controls 95 per cent. of the industry in this country and all important patents. The company begins business with $1,000,000 of cash working capital. The net earnings are conservatively estimated at $750,000 a year, which is equal to six per cent. on the $4,000,000 of preferred stock and eight per cent. on the $6,000,000 of common stock outstanding. The company has no bonds and no debt of any kind.

The New York and Queens Light and Power company has placed on the market five per cent. gold bonds, aggregating $100,000. The company controls the electric light and power business in that portion of Greater New York formerly comprised within the villages of Flushing, Whitestone and College Point and the town of Flushing. All of the franchises of the company are perpetual, except one for 25 years with the privilege of renewal. The company does all the public electric lighting in the territory described, under five and 10-year contracts, and has in addition a large commercial lighting and power business.

Final arrangements have been completed for a consolidation of the Baltimore Consolidated Railway company, the Baltimore City Passenger Railway company, the Baltimore and Northern Railway company and the Baltimore, Middle River and Sparrow's Point Railway company. This brings all the street-car companies in the city under one management. The deal involves $28,000,000. A new company will be formed, which will take over the combined properties. Mr. Brown, the New York broker, who engineered the deal, will be an important factor in the management of the property, and the financial management may devolve upon him. Mr. Brown also arranged the consolidation of street-railway properties in Pittsburg under the name of the United Traction company. That deal involved upward of $30,000,000. He also arranged the consolidation of the electric-light plants and railway lines of Newport News, Old Point Comfort and Hampton, Va., and is now engaged in perfecting the consolidation of all the electric light and gas companies and the United Traction company of Pittsburg, involving $26,000,000. Mr. Brown is also interested in the proposed consolidation of the street car companies of St. Louis.

The gas and electric-light companies of Pittsburg have effected a combination, it is announced, and they will be under one control after January 1st, according to a statement made by one of the men in the deal. The companies embraced include the Philadelphia Gas company, the Consolidated Gas company and the Allegheny County Electric Light company. The combination of the gas and electric-light companies of Pittsburg means the formation of a new company having an enormous capitalization. The Consolidated Gas company has $6,500,000 in shares and $5,000,000 five per cent. bonds. The preferred stock is $4,000,000 guaranteed six per cent. and the common $2,500,000. The Philadelphia company has $7,500,000 and the Allegheny County Electric Light $1,500,000. These three alone make a total of $20,500,000. In addition, it is believed that the new combination includes the Allegheny Heating company, capital $500,000; the Chartiers Valley Gas company, capital $4,000,000; the Pennsylvania Natural Gas company, capital $1,00,000, bringing the total up to $26,000,000, as at present stated. The name for the new concern will be the Philadelphia Gas company, and all operations will be carried on under its charter. It is stated that the Allegheny County Light goes in at $200, the Philadelphia company at $40 and the Consolidated Gas common stock at $40.

MISCELLANEOUS.

The Kansas Municipal association, in its annual meeting at Fort Scott, on December 14th, urged the next Legislature to enact a municipal-ownership law, authorizing cities to condemn water, gas and electric-light plants and buy them in for municipal control at an appraised value, whether the franchises have expired or not.

The Treasury Department is inviting sealed proposals until December 27th for installing a system of iron-armored conduits or cold-drawn steel tubing with interior non-corrosive lining, wiring and distribution tablets in the United States postoffice building at Paterson, N. J. Plans and specifications may be had upon application to the department.

The secretary of the treasury has sent to Congress a letter submitting a deficiency appropriation for the War Department, part of which, to the extent of $174,000, is to be used for the installation, operation and maintenance of military telegraph and cable lines, to be immediately available and to continue to be available until December 31, 1899. The immediate necessity for the foregoing appropriation is urged by General Greely, chief signal officer, U. S. A. The matter has been referred to the committee on appropriations.

The chief of the Bureau of Yards and Docks, Navy Department, has invited sealed proposals for enlarging the electric-light and power plant at the Boston navy yard. Bids are also asked for extending the wiring system at the same yard. Specifications, blank forms of proposal, a general plan and a wiring plan will be furnished intending bidders upon application to Mordecai T. Endicott, chief of bureau, Washington, D. C., or the commandant of the Boston navy yard. Bidders are expected to inform themselves of the character of the work by visiting the navy yard.

The Niagara Electro-chemical company of Niagara Falls has awarded the contracts for an addition 50 by 125 feet, to be made to its works on the lands of the Niagara Falls Power company. The building will be of brick, with iron girders, and have a Mackwirth roof. It will form an addition to the sodium-peroxide department, and it is expected that it will be fireproof. The company will not at present increase its supply of electrical power, but in the near future expects to contract with the Niagara Falls Power company for a large additional block of the electric energy. The new building is expected to be completed by the early part of February.

The Manufacturers' Association of Canada has called the attention of the Anglo-American commission to the fact that the United States Immigration Bureau has recently made a number of rulings to the effect that the commercial travelers of Canada fall within the restrictions of the alien-labor law, and that they cannot carry on their work on this side of the border. In bringing the matter before the commission, the statement is made that a large number of commercial travelers from the United States have regular routes through Canada, and that if this country intends to exclude Canadian salesmen, the Canadian government will perforce retaliate by excluding American salesmen from Canada. Should this policy be followed, it will work great hardship to the manufacturers of electrical apparatus and appliances, many of whom have salesmen traversing Canada in every direction, and they will have to be recalled. Efforts will be made, however, to have the restrictions removed on both sides.

United States consular reports direct attention to the fact that excellent opportunities are being offered in Chemnitz and adjacent cities in Germany for the importation of American tools, electric appliances and all kinds of articles used in the construction and equipment of electric railways. The city of Chemnitz is just now contracting with the local electric railway to extend its system in four different directions. The new lines, when built, will be as long as, if not longer than, those now in use. For a long time city ownership was discussed, and a committee was finally appointed to consider the matter. Several companies made bids, but it was finally deemed best to let the company make its own contracts and build the new lines. The superiority of American appliances is acknowledged in Germany. Evidence of this fact is found everywhere in imitations attempted by machine builders in the cities of the empire. If the manufacturer or inventor in America neglects patent rights in Germany, he has no ground for redress. One cannot too strongly urge care in patenting inventions, for in Germany there is no hesitation shown about taking American machines apart for the purposes of imitation. Besides, the patent laws put it out of the power of outsiders to import into the empire, excepting for a short time. If the thing is patented there, it must be made or manufactured there; if it is not patented, it will be imitated. In either case, unless provided with enormous capital, the American is compelled to give up a large part of his profits.

TRADE NEWS.

The New York Trade School has recently placed in operation two 70 horse power engines of the Ball Engine company of Erie, Pa., direct-connected to Siemens & Halske generators. St. Agnes Hospital, Philadelphia, has its electric plant in operation, including two engines of the same kind connected to Eddy dynamos. The Billings Water Power company of Billings, Mont., has recently placed in operation a 150 horse power tandem-compound engine of the Ball company's make.

The Eureka Electric company's new No. 44 transmitter possesses beauty of design and symmetry and great volume of tone, combined with clearness of articulation. It has a metal diaphragm, and does not employ any other elements in its construction other than carbon and metals. It is of the solid-back type, full nickeled and is built to be mounted upon the magneto box or on the long-distance arm. Its construction is such that packing is out of the question, and the company guarantees each transmitter indefinitely. This transmitter, in connection with the company's new double-pole receiver, makes a set that is capable of long-distance work.

The Moloney transformer, for which the Western Electrical Supply company is general western selling agent, seems to be meeting with very favorable results, judging from the large and constantly increasing business which the Western Electrical Supply company reports in this line. That company carries a large and well assorted stock of these transformers in St. Louis, and will give its customers the benefit of prompt shipment. It will be pleased to furnish prices and data on application. The same company reports very large sales for its well-known Monarch incandescent lamp, which it is claimed is in some respects superior to any other incandescent lamp on the market.

BUSINESS.

Laurence W. Frank of Philadelphia has purchased the business of the Technic Electrical Works at 214 New street, and will continue it, under the management of R. L. Binder, with increased capital and improved equipment.

The Chicago office of the Buckeye Electric company reports large sales of the Buckeye special coiled-filament lamps. Central-station managers are taking kindly to the Buckeye lamps because of the combined life and sustained candle power shown by the specially prepared filament used.

The G. & P. Engraving company is the oldest house in Boston making a specialty of name plates, and the policy is not to furnish cheap work, but good work at a reasonable price. It is presenting a souvenir to each of its customers, in the form of a handsome paperweight.

The Chicago Fuse Wire and Manufacturing company reports that the demand for its products is taxing its facilities to the utmost. This company's goods are known all over the country, and it is only natural that its business should show a constant and steady increase. The company's success is due in no small measure to the efforts of its manager, W. R. Goodman.

Corrugated steel sheets are used in the United States navy. They are commonly used for roofing purposes. The Cincinnati Corrugating company of Piqua, O., after demonstrating the practicability of this material as a fire-proof, rigid and durable substance, succeeded in having it introduced in the construction of the new United States battleship Wis-

consin, now being built by the Union Iron Works at San Francisco, Cal., for partitioning compartments.

The Washington (Pa.) Electric Light and Power company, Washington, Pa., has recently increased the capacity of its station by the addition of a 175 horse power engine. The California Powder Works of San Francisco has purchased a 100 horse power tandem-compound engine for its electrical plant. The Sheffield Electric Light company, Sheffield, Ill., is installing an electric-light plant. The Ball Engine company of Erie, Pa., is furnishing the engines for these installations.

The Boston and Maine Railroad company is erecting at Portsmouth, N. H., an electric power station. The building is 118 feet wide and 64 feet long, divided into two rooms—one for the boilers and the other for the engines and electric generators. The side walls are of brick and the roof construction is fireproof. The trusses are of steel, and they support steel beams for the purlins, on which is to be placed a concrete roof. The contract for the steel work was given to the Berlin Iron Bridge company of East Berlin, Conn.

The Electric Appliance company is calling particular attention to the Jenkins switch, which is the latest arrival in the field of snap switches. The Electric Appliance company claims that it is in a position to sell these switches at a very much lower figure than has ever been offered before on a first-class article. It solicits an opportunity to quote prices to all users of snap switches.

Considerable has been written lately about an old sign in possession of the Western Society of Engineers at Chicago. The words "Harper's Ferry," painted in black, stand out as boldly as when they were first formed by the artist's brush, while the wood around the letters, which was painted with white paint, has worn away about one-sixteenth of an inch. It is asserted by the writers that no paint manufactured nowadays is equal in durability to that which was applied on the old sign. William Hooper of Ticonderoga, N. Y., does not see anything especially remarkable in the preservation of the old sign and claims that there is just as good a paint made nowadays as then. He relates several interesting incidents in this line and adds: "If the surface to be painted is perfectly dry when the finely ground graphite is applied, the paint will prove the most lasting paint known, because if time eliminates all of the oil, the graphite seems to adhere to the surface painted just the same as a piece of paper or wood will appear after it has been rubbed with a lead pencil or a piece of graphite. No other pigment known to me will remain on the surface painted after the oil has been thoroughly destroyed. With the experience I have had with graphite paint, I thoroughly believe that if any dry surface be covered with graphite paint and left untouched for a period of 30 years —by which time the oil will have disappeared—no doubt a letter could be written plainly on the surface by using a piece of large wire or nail, after smoothing the end of the wire or nail which is to be used as a pencil. I have done all this and shown it up to others. Writing with the piece of wire polishes the graphite, which adheres to the surface, showing that it is there still."

ILLUSTRATED ELECTRICAL PATENT RECORD.

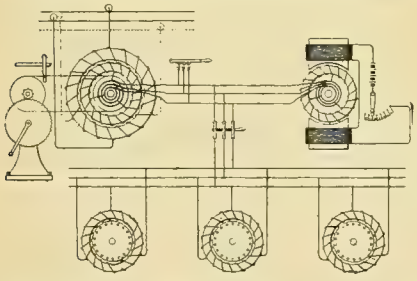
Issued December 13, 1898

615,669. Thermostat. Ira F. Beers and Frederic C. Beers, Rochester, N. Y. Application filed April 5, 1897.

The body is provided with suitable binding posts and contact points, one of which is made adjustable, combined with a pintle upon the lower end of the body; a thermostatic bar is mounted upon the pintle, an extension of the thermostatic bar extending up between the two contact points; a spring secured to a lug upon the body has its lower end arranged to exert a pull upon the pintle, and a regulating screw has its lower end bear against the pintle upon the opposite side from the spring.

615,673. Method of and Apparatus for Electrically Transmitting Power. Charles S. Bradley, Avon, N. Y. Application filed July 14, 1897.

The method is described of altering the rate of an alternating current consisting in leading the current through a motor-generator, feeding an armature from the secondary of the generator, and varying the strength of the field magnetism coöperating with the armature to adjust the capacity of the circuit to the required rate.



NO. 615,673.

615,686. Electric Lamp. Walter S. Doe, Jersey City, N. J. Application filed August 12, 1897. Renewed April 29, 1898.

This lamp comprises a metallic casing, a coiled spring secured at one end in the casing and into which screws the bulb of the lamp, and a battery having a jar of an insulated material and removably contained in the casing, the jar having a contact plate to make a contact with the bulb on placing the battery into the casing.

615,699. Electroplating Apparatus. John E. Hartley and Herbert E. Hartley, Birmingham, England. Application filed December 28, 1897.

The cathode and anode are rigidly connected and revoluble about a vertical axis, suspended by chains or cords from a stem, with electrical connections.

615,723. Fire-alarm Indicator. Leonard Le Baron, Pensacola, Fla. Application filed September 29, 1897.

A main indicator having a mainspring, a stationary arm having one end situated opposite to and adapted to encompass the spring, a lever having one end situated opposite to and adapted to encompass the spring, and an auxiliary indicator in a circuit, one terminal of which is carried by the other end of the lever and the other terminal by the other end of the arm.

615,731. Dynamo-electric Machine. William M. Mordey, Loughborough, England. Application filed February 15, 1897.

Claim is made for an armature having each element of its winding arranged as a pair of coils or separate portions so disposed and connected that during the greater part of the revolution the electromotive forces in the two coils or the separate portions are additive, while at the time of commutation they are in opposition.

615,732. Dynamo-electric Machine. William M. Mordey, Loughborough, England. Original application filed February 15, 1897. Divided and this application filed December 30, 1897.

A multipolar dynamo-electric machine is provided with a drum armature having a toothed, slotted or channeled core and a winding the coils of which composing each element are so arranged as to oppose one another during the moment of commutation but to aid one another during the greater part of each revolution.

615,762. Railway-crossing Signal. John D. Taylor, Chillicothe, Ohio. Application filed January 12, 1898.

A railway-crossing signal is described comprising a bell, an electric motor, a motor circuit, a track circuit for controlling the motor circuit, a spiral cam operated by the motor, an angle lever, one arm of which is engaged with the periphery of the cam, a bell-sounding hammer carried by the other arm of the lever, another cam, a lever adapted to engage with the other cam, to place the lever and cam in the electric circuit of the motor, and means carried by the cam for moving the lever into engagement with another circuit, or to cut out the motor circuit.

615,814. Electric Firing Device for Ordnance. Arthur T. Dawson and George T. Buckham, London, England. Application filed May 16, 1898.

The apparatus consists of a wire connecting a source of electricity to a spring plunger, a trigger lever having an arm adapted to form a conducting bridge to a piece of metal, a wire connecting this piece of metal to a switch on the gun cradle, this switch being provided with a spring and lever arm having a pin in the path of the breech-ring of the gun, and a wire connecting the switch to the firing fuse.

615,896. Vacuum Insulator for Electric Conductors. Joseph A. Poché, New Orleans, La. Application filed October 6, 1898.

An insulator for electric conductors, consisting of a sleeve through which the conductor is adapted to pass and a chamber surrounding the sleeve and secured thereon air tight, the chamber being exhausted of air to create a high vacuum therein and form an internal resistance in the insulator.

615,904. Electric-lighting Apparatus for Railway Cars. Willard F. Richards, Buffalo, N. Y. Application filed July 7, 1898.

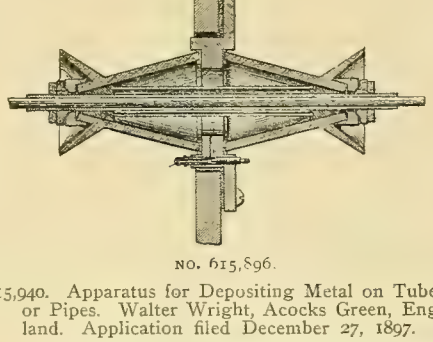
The dynamo is mounted on the car with a frictional driving mechanism for driving the dynamo from the axle, an adjusting device for regulating the tension of the driving mechanism, and means independent of the adjusting device for throwing the driving mechanism out of gear for stopping the dynamo.

615,905. Electric-lighting Apparatus for Railway Cars. Willard F. Richards, Buffalo, N. Y. Application filed July 9, 1898.

The axles are provided with a pulley, and a dynamo is pivotally supported at one end on the railway car, whereby its opposite free end is capable of moving vertically with reference to the car axle; an adjustable pressure device tends to move the opposite free end of the dynamo away from the driving axle, and a frictional mechanism drives the dynamo from the car axle.

615,927. Electric Arc Headlight. William G. Wagenhals, Dayton, Ohio. Application filed November 18, 1897.

An electric arc headlight has a case and a parabolic reflector provided with upper and lower openings on a line with the focal point thereof, and an electric arc lamp fixture is mounted on a base and contained within the case; a positive and a negative carbon are adjustably supported by the lamp fixture and extend through the openings.



NO. 615,896.

615,940. Apparatus for Depositing Metal on Tubes or Pipes. Walter Wright, Acocks Green, England. Application filed December 27, 1897.

In an apparatus for the electro-deposition of metal on pipes, tubes and other articles, a pair of revolving disks is employed, each having a series of carriers fixed around their adjacent faces on which the tubes or other articles are supported and are independently rotatable as they revolve together with the disks. One disk forms a part of the circuit through which the electric current passes, and with a revolving disk carries one end of the anode rods.

615,952. Alternating-current Generator. Charles S. Bradley, Avon, N. Y. Application filed July 14, 1897.

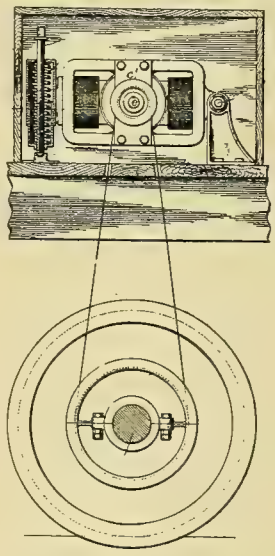
An alternating-current system comprises a generator operated by a prime mover, an exciter for developing a rotary field in the primary member of the generator, the exciter having its field magnet charged by a direct current of variable intensity, and a work circuit supplied by the secondary of the generator.

615,953. Controlling Alternating-current Motors. Charles S. Bradley, Avon, N. Y. Application filed July 14, 1897.

An alternating-current system is described comprising a source of alternating currents, a free-running motor-generator supplied thereby, a work circuit supplied with alternating currents by the motor-generator, a plurality of motors having their armatures supplied by the work circuit and their field magnets excited by direct current, and means for varying the strength of the direct current.

615,954. Changing Period and Phase of Alternating Currents. Charles S. Bradley, Avon, N. Y. Application filed June 22, 1896.

A motor-generator is provided with a field magnet adapted to be charged by an alternating current and a polyphase armature having in each circuit devices for varying the capacity inductance product.



NO. 615,905.

615,966. Trolley Replacer for Electric Railways. Lucian A. Cowles, Randolph, Mass. Application filed Feb. 7, 1898.

A trolley-wheel restoring device is composed of a forked lever, properly connected with the trolley pole and wheel, and having the ends, swinging guides slotted and adapted to be moved by the ends of the forked lever, proper mechanism for connecting and operating the lever and guides in connection with the trolley pole, and a spring normally holding the device out of action.

616,035. Electric Motor. Julius L. Thoma, Kansas City, Mo. Application filed June 20, 1898.

The machine comprises a circular series of magnets, a commutator arranged concentrically thereof and composed of a corresponding series of insulated strips, wires connecting the series of magnets and strips, a shaft suitably journaled, an armature mounted thereon and embodying a plurality of coils, a frame also mounted upon the shaft, brushes carried by but insulated from the frame and engaging the commutator, and electrically connected to an opposite pair of the armature coils, electric conductors between the coils and the other armature coils, conductors between the latter and the armature frame, conductors connected to the frame, and conductors connected to the magnets.

616,046. Telephone Switchboard. Thomas F. Ahern, Detroit, Mich. Application filed May 27, 1897.

In this switchboard there are two divisions, an answering division and a connecting division, each division having an independent line jack for each subscriber's line circuit and permanently connected therewith, and each division having a companion local jack for each subscriber's line, the local jacks being permanently connected between the divisions by trunk lines through which the talking circuit is made, and means for electrically connecting the line jacks and the local jacks.

616,061. Trolley-wheel Replacer. George E. Mittinger, Jr., Cleveland, Ohio. Application filed September 2, 1898.

A combined trolley and replacer comprises separate trolley and replacing sections, the replacing sections having in their outer ends inwardly projecting concentric ball cavities, the supporting arms having a bearing block with a ball recess registering with the recess of the replacing sections, and a single ball arranged in the cavities.

Western Electrician.
EVERY SATURDAY.
Vol. XXIII. CHICAGO, DECEMBER 31, 1898. No. 27

Holiday Illumination in Chicago.

Chicago's streets in the downtown retail district presented a brilliantly attractive appearance during the holiday season. The crowds of happy shoppers and sight-seers were larger than in former years and the merchants reported that the volume of business was far greater than ever before in the history of the city. It was a practical and convincing illustration of the improvement in the industrial condition of the country, and was emphasized by the fact that the throngs, which were made up from every walk of life, appeared happy and contented and showed signs of prosperity. Many of the leading merchants of the city have publicly announced that their business was greatly improved, and one of the most important houses in the city published the statement in its advertisement the day after Christmas that the season just closed has been so remarkable that it warrants especial mention." Summarizing the results, it says: "During the month of December we have broken previous best records and far outstripped former highest sales in over 70 sections of this store. We have placed to our credit very, very much the largest month's sales, week's sales and day's sales in the history of the house. Practically every department containing merchandise which can be classed as 'Christmas goods' shows also the largest month, week and day's sales in its history, and many departments containing staple merchandise, and not at all associated with holiday shopping, have made new and much higher December records." The same may be said concerning the retail business generally. The merchants put forth unusual efforts to attract the crowds, and the result was gratifying in every particular.

All of the big department stores downtown kept open during the evening for a week before Christmas, and the night scene on State street was even more attractive than the picture presented during the day. The huge buildings, which crowd upon each other in the retail district, were brightened by the liberal use of electric lights. The show-windows were, of course, filled with toys and souvenirs of the season, attractively arranged to catch the eye of intending purchasers. Many of the displays were set off by hundreds of incandescent lamps, and the flood of light from these added greatly to the general effect. Some idea of the appearance of State street, in the dry-goods district, between Madison street and the Union loop at Lake street, may be gained from the picture on this page. The street at this point particularly was thronged with busy purchasers late into the night, and presented almost as lively a picture as the same thoroughfare during the day.

HOLIDAY ILLUMINATION IN CHICAGO.—STATE STREET ON CHRISTMAS EVE.

There were, of course, many attractive displays in which electric-lighting effects played a conspicuous part, and a few of the most noteworthy are reproduced in the illustrations on page 366. Two of them were selected from the dry-goods district and two from the clothing houses. They were the most striking features of the decorations.

Mandel Brothers claimed the distinction of having the most artistic show-window on State street, and the claim was allowed by general consent. The scene depicted was a representation of fairyland, in which dolls and doves, dainty costumes and glittering gems contributed to a beautiful picture under the soft light diffused by incandescent lamps, half hidden in the decorations. Another very attractive window in which electric lighting was an important factor was the handkerchief window of the same house. Here, too, the lamps were artistically arranged and the effect was soft and beautiful.

Among the clothing stores which employ electric lighting very liberally in attracting attention to their goods, the most conspicuous were those illustrated in the pictures on page 366. The Griesheimer show-windows are outlined in incandescent lamps, and the huge illuminated sign in front of the store, in which the lights are turned on and off by a motor, attracted its share of attention. Another pretentious exhibit was that of Woolf's clothing store, which was really a glare of light. Here, too, the windows were outlined in incandescent lamps and in the center of each was an immense horseshoe studded with incandescent lamps. It was certainly effective, and as an advertisement was voted all that was desired.

Other parts of the downtown district presented attractive displays, scarcely less pretentious than those in the district just mentioned. It was apparent that the use of electric lights for decorative purposes and sign work was growing more popular each year. Another unmistakeable indication of the same tendency is found in the records of the Chicago Edison company, which furnishes the greater amount of current consumed in the city. The maximum low-tension output in kilowatts for Monday, December 20, 1897, was 7,521 and on Monday, December 19, 1898, 8,861, an increase in 1898 over 1897 of 17.9 per cent. The total low-tension output in kilowatt-hours for five business days of the holiday week of December 20th to 24th inclusive last year was 314,599, while that for December 19th, 20th, 22d, 23d and 24th this year was 387,958, showing an increase of 23.3 per cent. The maximum amperes of the low-tension system in that period was reached on Monday, December 20, 1897, and was 52,390, while this year's was noted on Monday, December 19th, when 62,525 was recorded. The increase of 1898 over 1897 was 19.3 per cent.

National Exposition at Philadelphia in 1899.

[Special correspondence of the Western Electrician.]

Washington, D. C., December 23.—Among the many striking features in recent American development, none is perhaps more universally remarked than the tendency on the part of electrical manufacturers to seek in foreign countries new markets for the sale of their goods. This export movement has been so systematic as to point to something more than temporary need or passing opportunity. Experience has shown that American electrical goods meet with favor among foreign buyers. They compete with European goods, not only in fields common to both, such as South America, Africa, Australia, but in Europe and England itself, at the very doors of the factories of their competitors.

The march of American export trade to the position which it can rightly claim in the world's commerce has been hindered and delayed by two causes; first, lack of information on the part of American manufacturers as to the specific requirements of the markets they wish to enter and control; and, second, lack of information on the part of foreign buyers respecting the superiority of American productions, due to the absence of any systematic attempt to enlighten them.

It is desirable to encourage the extension of American industries, the increase of exports, reaching and developing new markets, especially at this time of strenuous effort on the part of American manufacturers to build up markets for their products in foreign countries; and the generally favorable reception given to such American manufactures, especially electrical goods, as have been sent abroad, indicates a relative excellence which assures them of a much wider demand if the conditions of such demand shall be generally studied and realized in the United States.

To carry out this idea Congress has authorized the holding of a National Exposition of American Products and Manufactures, especially suited for export, at Philadelphia, Pa., in the year 1899. It has also appropriated the sum of $50,000 for enabling the collection in foreign markets of samples of merchandise in favor and demand therein, and illustrating the manner in which merchandise for such markets should be prepared and packed, together with necessary data for the instruction and benefit of American manufacturers, and thereby laying the foundation of a great system of national commercial education.

The desirability of encouraging American industries may be regarded as self-evident, and it is believed that opportunities therefore now exist and for years have existed and may be secured by a dissem-

ination throughout the United States of valuable information touching the conditions thereof. The necessity of an available center of information has long been recognized by leading producers and exporters, and many efforts have been made to establish the same, but, not being properly organized or encouraged, proved ephemeral until recently.

The objects of the proposed exposition are to show to foreign buyers the goods American manufacturers offer for export, and to establish their superiority; to show to American manufacturers the character of the goods they must compete with in the open markets of the world; to show how American goods should be packed, labeled and put up for export trade; to bring the manufacturers of the United States in direct personal contact with the principal buyers, merchants and bankers of foreign countries.

The exhibit of American manufacturers will constitute the most extensive feature of the enterprise. This department will include numerous sections, classified according to products exhibited. There will be an electrical section; a machinery section, supplied with necessary power, in which the best types of American inventive genius will be displayed; a section devoted to transportation, of particular importance now that surface railways of every kind are being so extensively constructed in new countries.

Another department of the exposition will show in detail how American goods must be packed, labeled and shipped in order to meet the requirements of foreign trade. The value of this department can hardly be overestimated. In some countries, for instance, forms of packing that are usual with us entail heavy losses on foreign merchants through increased import duties. In other cases custom-house regulations require packages to be marked on the sides, with stencil, or in other ways not usual in the United States. Ignorance of these requirements has more than once led to serious losses, and even bad feeling between the American manufacturer, who does not realize the necessity of departing from home methods, and the foreign merchant, who thinks that he is being willfully injured. This department will aim to include all necessary specimens, models and exhibits to obviate in the future all difficulties of this character.

The exposition will open May 10, 1899, and continue for a period of five months. Its primary object will be to foster and encourage American export trade. It will be the first of its kind ever held in the United States, and in its scope it will be thoroughly national. It will be unique in that its exhibits will be designed to represent the best and most suitable products of the best American factories. A. F. T.

Performance of Electrical Apparatus on Ship-board During the Late War With Spain.[1]

By F. W. Roller.

In addressing the society this evening, let me preface my remarks with the statement that much of what I shall have to say is based on hearsay evidence, as is necessarily the case, but that the opinions of the numerous other officers with whom I have spoken on the subject seemed to agree so well that I believe you may take the conclusions as generally correct.

In the first place we will divide the electrical appliances that we had into two different classes and compare them.

The first of these will include the indicating apparatus, such as the engine room and other telegraphs, speed and direction indicators, helm-angle indicators and the range finder. All of these instruments are of the galvanometer type, there being a galvanometer at the receiving end with its scale divided in yards, range, degrees, revolutions or arbitrary orders instead of volts or amperes, and actuated by differences of potential produced at their terminals from the sending end. They are in consequence delicate in construction and easily get out of adjustment, but they have the advantage of flexibility and possibility of the use of a large number of receiving stations, as well as the minor one of requiring inappreciable amounts of energy.

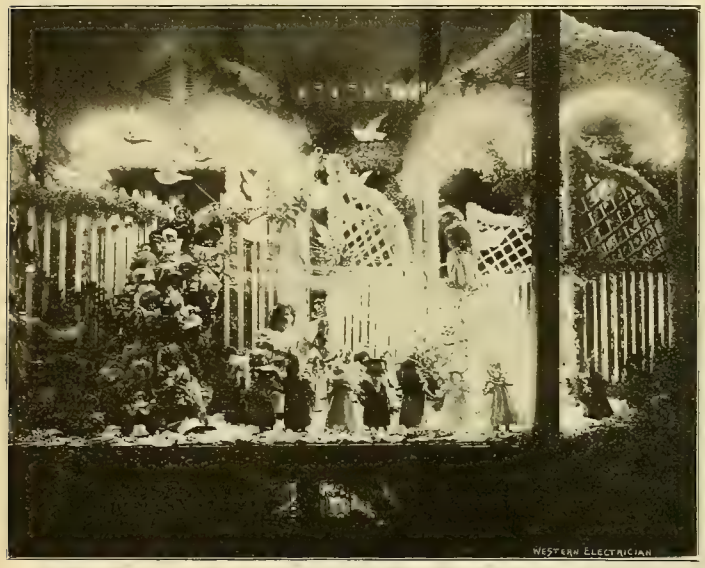
In general, it may be said that their performance was not satisfactory. In some cases, say that of the range finder, the trouble cannot be attributed entirely to electrical reasons. In this instrument, where we in reality measure the altitude of a triangle from the known base line (the distance between the two telescopes) and the angles adjacent thereto (those made by the telescopes with the base line when bearing on the target), the base is so very short in comparison to the other two sides, that unless the glasses are very carefully trained and the whole apparatus in perfect adjustment, a very considerable error will arise. It is easy to see how large this error may be when we know that the glasses could only in the most advantageous cases be placed as far as 300 feet part, and that the minimum distance from the target when it is likely they will commence to be used is 3,000 yards; the altitude is here 30 times the base. In addition to this, I understand that the device in several cases proved to be unable to withstand the concussion of the heavy gun fire. Under the circumstances, it is natural that their use should have been largely abandoned and, instead, the secondary battery used. With the great rapidity of fire of this, it was easy to take a large rapid-fire gun, load with common shell, estimate the distance by eye, run up the sights for that and fire. If a hit was made, that was the range; if not, the shell would be seen as it struck the water, the sights readjusted accordingly, and, the gun having been reloaded in the meantime, another shot taken. It was rarely necessary to make more than two or three trials of this kind before the range was had to a nicety, and then the main battery could be opened up. But let us return to our subject of the instruments.

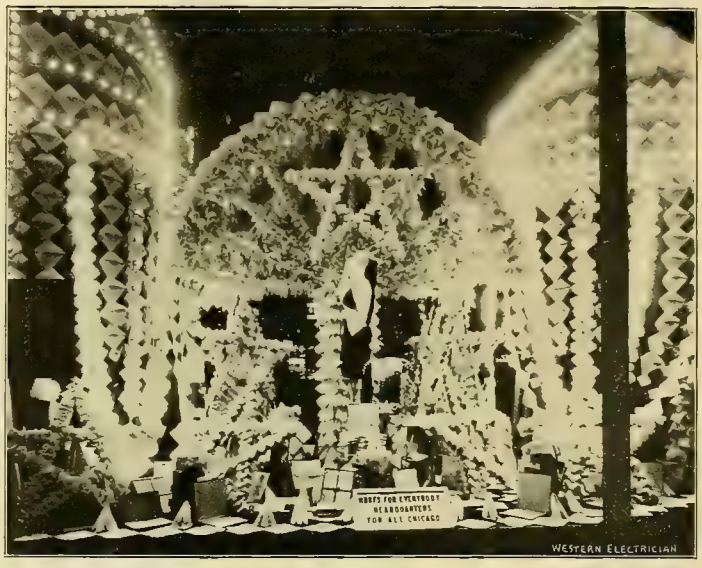
They had another feature that contributed to their lack of success, which was the difficulty of locating any derangement that might arise. The men were used only to mechanical devices, and a fault that could neither be seen nor detected by the ear seemed to them most mysterious, outside of the fact that the testing, even when understood, was none too simple, and was rendered still more difficult by the surrounding conditions. As a consequence, a few troubles made them disgusted and the instruments got the reputation of being far worse than they were.

There is one other class of electric device that can be said to fall in this first class, in that it employs currents of small strength. This is the electric firing arrangement that was used on some of the rapid-fire guns. But few of the ships were fitted with this; the Nashville was one, and although we had on the whole the most satisfactory results from it, two or three of the others had, I understand, some trouble from miss-fires.

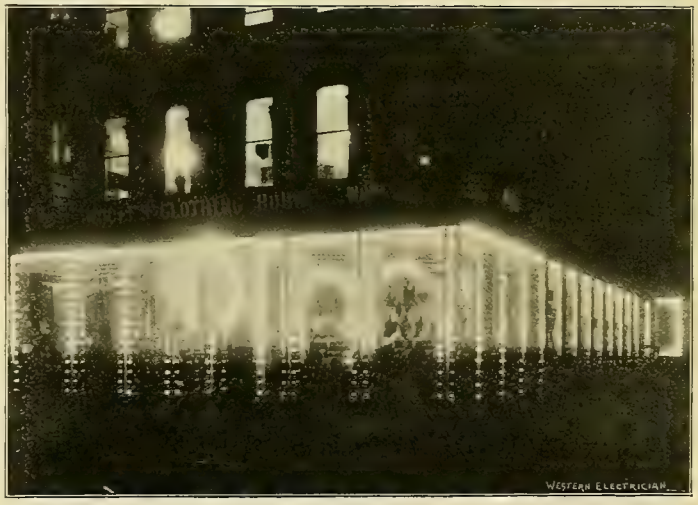
This, however, was undoubtedly due to the low battery power furnished to set off the primers, there being a litttle case holding three small-sized dry

1. Read before the New York Electrical Society, November 14, 1898.





Attractive Display in Dry Goods District.



Typical Show-windows in Clothing District.
HOLIDAY ILLUMINATION IN CHICAGO.

cells secured to the gun mounts which were supposed to give all that was required. They did, as a rule, but dry batteries are not always reliable, anyway, and standing exposed in a metal case to the intense rays of the sun day in and day out did not tend to help matters any. A more powerful type of cell would undoubtedly make them certain in their action, and as the breech plugs fitted for electric firing are far more simple mechanically than the other types, there is little doubt but that they will be permanently retained.

Leaving now our first general class, we come to class number two. This includes all appliances requiring considerable amounts of current for their operation, and takes in the incandescent lamps, the searchlights and the motors.

FIG. 1. NEW SUSPENSION BRIDGE AT NIAGARA.

It may appear strange that special stress should be laid here to the incandescent lamp, as its advantages seem obvious; but it is of extreme value in many ways that are not so apparent at first glance. If we take the easy control of all the lights from a central point, for instance, here, alone, is a point of the greatest importance. On a regular man-of-war all the lights that are out of sight, and those necessary for the operation of the guns at night, which are fitted with shields to obscure them, are grouped on a common "battle circuit," so that under war conditions all of the other circuit switches may be opened at sundown with the perfect assurance that after that there will be no glimmer of light to betray the vessel's position. On the auxiliary vessels that we had there was no such provision, with the consequence that, in spite of the vigilance of the officers, they were bound to be found sooner or later with an unauthorized light going somewhere.

It was easy then to see them at quite a distance, and an enemy's ship would have had a great advantage over them, whether she was chasing or trying to slip by. Another place where the electric light was practicaily indispensable was for the night-signal work.

The regular ships were, of course, fitted with our standard "Ardois" sets, which consist of a string of five lanterns, each half clear glass and half red, inside of each of which were two lamps, either of which could be lit independently, and, by means of a keyboard, the different combinations that formed the signals made. These were always ready, and it was but a second's work to flash the private signal at any craft that was deemed suspicious before betraying your own position too markedly by turning on the searchlight or going further and opening fire. The other ships had to have a number of ordinary lanterns ready lit concealed from observation, which they would bend on a pair of signal halliards and hoist when they had a communication to make, an operation requiring considerable time. That this time element was important, is illustrated by an incident which came under my observation while on the Havana blockade in the early part of the war. There the captain of one of our auxiliary vessels fired on another one of them one night, fortunately discovering his error before any harm was done. He explained his action the next morning by stating that he only saw the other craft when she was very close to him and thought that she was trying to get in; that was "no time for signals, where he had all that lantern business to go through;" so he fired first and asked questions afterward.

We now come to the second device in our class two, the searchlight. The value of this was proven beyond all possibility of doubt in this war; not only was it valuable, but I think we can go much further and say that if it had not been for it there is a strong probability that the war would not even yet be over.

We learned afterward that, at Santiago, leaving aside the practical certainty of night attacks from the harbor of the enemy's torpedo boats, which would have stood an excellent chance of success, Cervera had fully determined to make a night dash to escape. This was rendered an impossibility by the searchlight beams that were kept on the harbor entrance the night through, which made the place as light as day for the ships that were behind the lights and simply dazzled the eyes of any attempting to get out, rendering the navigation of the tortuous channel exceedingly hazardous and making shooting practically impossible for them. In consequence he found it on the whole better to make his trial in daylight, with the well-known result. If a night run had been feasible, owing to the lack of the searchlight, there is a strong probability that the majority at least of the Spanish ships would have gotten away clear, and if they had succeeded in making Havana, their dislodgement and the capture of the town would have been a problem of a far different and more difficult nature. An illustration of the power of the searchlight may be of interest. Of course, for the purpose of "picking up" an object they are of little use beyond a distance of two or perhaps three miles, but the light is visible at far greater ranges.

I have more than once, when off Havana, seen on the clouds the reflection of the searchlight that was mounted on the fort at Key West, a distance of over 80 miles, and have been able to follow the course of the beam as it swung from side to side.

Anticipating a query to that effect, I will say that I do not know of any attempt made to communicate with our vessels by this means.

The last of the power-consuming class, the motors, I have concluded not to enlarge on, as you are probably all familiar from reading the papers with their performance. The motors for ammunition hoists, turret training, ventilating-fan driving and, in some cases, steering gear, gave results so far more satisfactory than any other method of control and operation that their continued use is firmly established. The few failures that occurred were far less in number than those of their steam-driven equivalents, and were even then in most cases traceable more to the lack of familiarity of the men with their apparatus than to any inherent defects of the system.

As a result of the foregoing, I think we may fairly conclude that, in general, the devices that are included in class number one are, as at present installed, of questionable utility, but that class two was an unqualified success and a monument to the engineering ability of our electrical profession.

New Suspension Bridge at Niagara.

By Orrin E. Dunlap.

The Lewiston Connecting Bridge company and the Queenston Heights Bridge company are about to erect a new suspension bridge across the Niagara River, near Lewiston, N. Y. It will occupy the site of a suspension bridge built in 1850-51, and which

FIG. 2. NEW SUSPENSION BRIDGE AT NIAGARA.

was in use until the early part of 1864, when it was wrecked by a windstorm. A view of the point where the bridge is to be built is shown in Fig. 1. The years of its existence had proved it to be an unprofitable investment, and so the companies owning it did not rebuild the structure. The cables and a small part of the deck swung over the river for years, and were cut down last fall to make way for the new bridge.

The new bridge is to have a cable span of 1,040 feet from tower to tower, while the span of the stiffening truss will be 800 feet. From center to center of trusses the width will be 28 feet, and the roadway will have a clear width of 25 feet. The floor will be of two-inch oak plank, laid crosswise, and through the center a single track will be laid for trolley cars. On each side of the track there will be ample room for teams to pass abreast. There will be no special walks provided for pedestrians, as the point at which the bridge is located is not likely to attract pedestrians, the anticipation of the promoters being that the greater part of the travel across it will be by trolley cars or in carriages. The stiffening truss will extend about four feet above the floor line, and the railings will be of light strips of iron flats reinforced with oak half rounds.

The cables will be four in number, each composed of 14 2¼-inch galvanized cast-steel wire ropes. These wire ropes will be obtained from the cables of the old upper suspension bridge at Niagara Falls, which was recently taken down and replaced by a new all-metal arch. The span of the old suspension bridge was much longer than that of the bridge now to be built at Lewiston, and the anchorages were situated some distance back from the towers, making the length of cables much longer than will be required for the new bridge. This will allow cutting the ropes of the old cables in half, and thus using them. But in this form they are not sufficiently long to fill out the entire cable span, and so about 75 feet at each end of the cable span is to be made up of eye-bars.

The cables will be anchored in solid rock, about 150 feet back from the edge of the bluff, the shafts to be filled with concrete. The clear height of the bridge above high-water mark will be 65 feet, and the suspended span is to be connected to the banks by approach spans, the one on the New York side to be 34 feet six inches long, and the one on the Canadian side to be 19 feet six inches long.

In all there will be four towers, two on each side of the river. In the construction of these towers the greater part of the stone of the old towers was used in the bases, while the new stone for the towers on the New York side came from the Euclid quarries, and the stone for the towers on the Canadian side from the Queenston, Ont., quarries. The towers on the New York side (shown in Fig. 2) are situated 28 feet back from the bluff. Their height is 26 feet, and their bases are 13 feet square. The Canadian towers have a height of 18 feet, bases 12 feet square, and are located 15 feet back from the bluff, the ledge on the Canadian side being more solid than that on the New York side. The inscription stones of the old towers, on both the Canadian side and the New York side, have been preserved and will have place in the new towers.

The capacity of the bridge is to be such that it will take care of the heaviest trolley-car travel likely to develop in the Niagara locality, together with a uniformly distributed load of 40 pounds to the square foot, over the entire structure. The weight of the metal to be used will be about 800 tons, and the cables will weigh 200 tons.

At each end of the site of the bridge it has been found necessary to construct long approaches in order that the trolley cars may reach the deck of the proposed bridge. Both of the approaches extend to the north of the bridge, the one on the New York side being 800 feet long and the one on the Canadian side having a length of about 1,000 feet. The width of the approaches is about 25 feet, and on them double tracks will be laid. Face walls, which are practically abutment walls, have been constructed to each approach. The approach wall on the New York side is shown in Fig. 3. It is about 19 feet high at its highest point and tapers at a one per cent. grade for 600 feet and for 200 feet at a two per cent. grade, until it reaches the level of the tracks of the Niagara Falls and Lewiston railroad. The high part of the wall is laid in cement, and the other parts are dry. On the completion of the bridge a face wall will be built to the east of the New York approach. These face walls prevent the native shale disintegrating under the weather, and over them a growth of vines will be encouraged. The expectation is that the Niagara Falls and Lewiston railroad tracks will be connected with the bridge on the New York side, and the tracks of the Niagara Falls Park and River railway with the Canadian end, thus leaving but a final link to be made to connect the street-railway tracks of Niagara Falls with the upper steel arch in order that a belt-line electric car service may be operated about the Niagara gorge.

The contract for the sub-structure was awarded to James Stewart & Co., and the contract for the superstructure to the New Jersey Steel and Iron company. The erecting force has arrived on the ground, and connection between the cliffs will soon be made. All the cable reels are on the New York side, and it is on that side that the iron will be delivered by the New York Central railroad. The erection of the superstructure will begin at the New York end. The consulting engineer is Mr. L. L. Buck, and the enigneer is Mr. R. S. Buck.

In the work so far accomplished an interesting fact noted by Engineer Buck is that the old cables and anchorages were found in a remarkable state of preservation, and especially those portions which, for all of 35 years, were buried in mud.

The officers of the Lewiston Connecting Bridge company are President William B. Rankine of New

FIG. 3. NEW SUSPENSION BRIDGE AT NIAGARA.

York; vice-president, J. T. Mott of Oswego; secretary-treasurer, J. M. Bostwick of Buffalo.

The Queenston Heights Bridge company officers are President Thomas G. Blackstock of Toronto, Ont.; vice-president, C. H. Smyth of Clinton, N. Y.; secretary-treasurer, J. M. Bostwick of Buffalo.

Atmospheric Electricity.

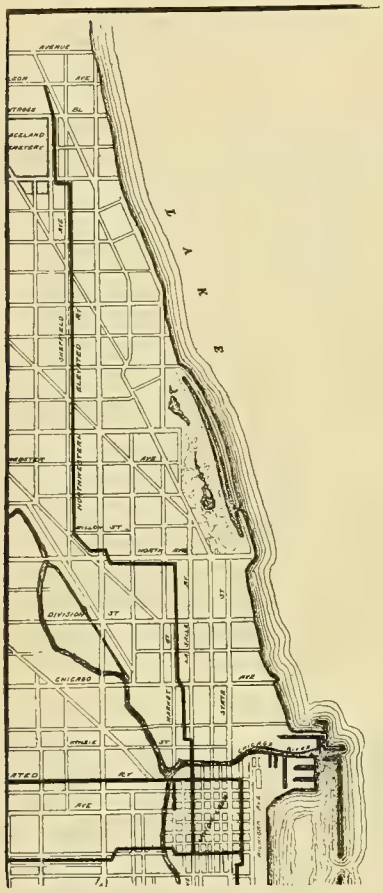
The month of September was unusally prolific in thunderstorms in this country, according to the official reports of the Weather Bureau. In that month 2,696 reports of thunderstorms were received, as against 1,732 in 1897, and 4,853 during the preceding month. The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 4th, 328; 5th, 210; 6th, 208; 2d, 193; 7th, 163. Reports were most numerous from Ohio, 243; Illinois, 215; New York, 169; Missouri, 153.

In Canada thunderstorms were reported at Grand Manan, Bermuda, Yarmouth, Charlottetown, Father

Point, Quebec, Montreal, Toronto, White River, Kingston, Port Stanley, Saugeen, Perry Sound, Port Arthur, Winnipeg, Banff, Minnedosa, Qu'Appelle and Swift Current.

Northwestern Elevated Electric Railway, Chicago.

Again the announcement is made that the Northwestern Elevated Electric Railway company has secured the necessary financial support to enable it to complete the construction of its system. Negotiations for a $4,500,000 loan were concluded last Saturday, thus making possible the completion of the road, which was abruptly abandoned in October, 1896, owing to lack of funds. Orders for ties and structural iron were given several weeks ago when the loan was assured, and as soon as these begin to arrive, it is announced, the work of building will be vigorously pushed. Meanwhile an army of foundation diggers will take immediate possession of the right-of-way, and by October 1, 1899, the entire line of six miles, beginning at the Wilson avenue terminus in the south end of Edgewater, will be in operation. Passengers will be landed at the loop, Fifth avenue and Lake street, 17 minutes after leaving Wilson avenue.



NORTHWESTERN ELEVATED ELECTRIC RAILWAY, CHICAGO.—ROUTE OF LINE.

From the northern terminus in Wilson avenue, west of Evanston avenue, the new road's route extends southeast in Dayton street, thence east to a point 200 feet east of Halsted street, south across North avenue in the rear of North avenue lots, east to Market street, turning into the Alexian Brothers' old hospital grounds, south along the line of Market street to Institute place, southeast to Chicago avenue and Franklin street, thence from Chicago avenue in Franklin street south to Michigan street, east in Michigan street to Wells street, thence south to Lake street and the Union Loop. Until the line strikes Chicago avenue no public property is traversed. Such portions of the right-of-way as have not been acquired by condemnation proceedings were obtained by purchase, including the Macalister tract of 400 acres, recently bought by Mr. Yerkes.

An electric system, similar to that now employed on the Lake Street and Metropolitan lines will be installed by the Northwestern elevated. The power house will be erected in Fullerton avenue.

The greatest novelty introduced by the system will include the four-track line to be maintained north of Chicago avenue for a stretch of 5.52 miles. This will enable the running of "express" trains in addition to an intermediate service. The plans also contemplate the possibility of sending outlying cars of surface "feeder" lines up an incline and attaching them to the regular elevated trains.

The company, last Saturday, lodged with the city a certificate of deposit for $100,000, guaranteeing completion of the road by January 1, 1900.

The financial end of the enterprise appears to have undergone complete reorganization. The old board of directors, composed largely of Charles T. Yerkes' personal associates, is supplanted mostly by men representing the interests of the contributed capital, including the following: C. Ledyard Blair and W. W. Miller, New York; E. L. Brewster, Clarence Buckingham, John C. Welling, Bryan Lathrop and D. H. Louderback, Chicago.

Mr. Louderback is retained as president of the company, with Mr. Brewster as vice-president, Howard Abel secretary and treasurer, and George F. Jewett auditor. The general offices will be at 444 North Clark street, which is headquarters for all the Yerkes' transit companies.

The loan of $4,500,000 was contributed by Blair & Co., bankers, New York ($2.500,000); Chicago stockholders ($1,500,000), Illinois Trust and Savings Bank ($500,000). It is secured by notes payable on or before 18 months from date, at the company's option, with interest at five per cent. Pledged as collateral with the Illinois Trust and Savings Bank, trustee, are $5,000,000 of first-mortgage five per cent. gold bonds, constituting the entire authorized issue, and 50,000 shares, of the par value of $100, preferred stock, and 50,000 shares of common, at $100 par, consuming the company's capital of $10,000,000. In the financial readjustment the bond issue was decreased from $15,000,000 to $5,000,000 and $5,000,000 clipped from the capital stock.

Telegraphy in Weather Forecasting.

The United States Weather Bureau has extended its service materially during the year, and the system now includes daily reports from the West Indies, Central and South America and the Mexican Gulf coast. In the annual report of the chief of the Weather Bureau, Willis L. Moore gave the following concise account of the government work in this branch of the service:

"During the latter part of the fiscal year it became apparent that the methods of gathering information of the approach of West Indian hurricanes, which served so admirably when warnings for the Gulf and Atlantic coasts only were issued, were wholly inadequate for a service that should cover the waters of the West Indies, in which upward of 200 naval and transport vessels of the United States were operating. The presence of this large fleet in the hurricane region made it imperative that precautionary measures, looking to its safety in time of severe atmospheric disturbances, be adopted at once. Accordingly, a bill was drafted and submitted to Congress on June 16, 1898, authorizing the bureau to establish and operate observing stations throughout the West Indies and along the shores of the Caribbean Sea. The provisions of the measure were incorporated in the general deficiency bill, which, it will be remembered, did not become law until after the close of the fiscal year that ended June 30, 1898.

"At that time, however, ararngements had been made to establish stations for making meteorological observations and displaying hurricane signals at the following points: Kingston, Santiago de Cuba, Santo Domingo, St. Thomas, Barbados, Port of Spain, Curacoa, and Barranquilla. At the places named observations will be made twice daily and cabled to Kingston and the Central office in Washington. It is expected that twice-daily observations will also be cabled from Martinique through the cooperation of the French meteorological service of that island.

"The Weather Bureau will receive, when the West Indian service is fully established, twice-daily telegraph reports, not only from the stations named, but also from Havana, Nassau, Vera Cruz, Tampico, Coatzacoalcos and Merida, through international comity and the voluntary co-operation of private persons. For daily reports from Havana acknowledgments are due to Professor Louis G. Carbonell, superintendent naval service of the Antilles; from Nassau, to His Excellency Sir Ambrose Shea, governor of the Bahamas; from Vera Cruz, Tampico and Coatzacoalcos, to the Mexican Telegraph company; from Merida, to a private observer, Senor Felix Gomez Mendicuti, C. E. The action of Professor Carbonell in forwarding daily weather reports from Havana during the period of hostilities between Spain and the United States is exceptionally gratifying to the officials of the bureau, as it must also be to scientists the world over.

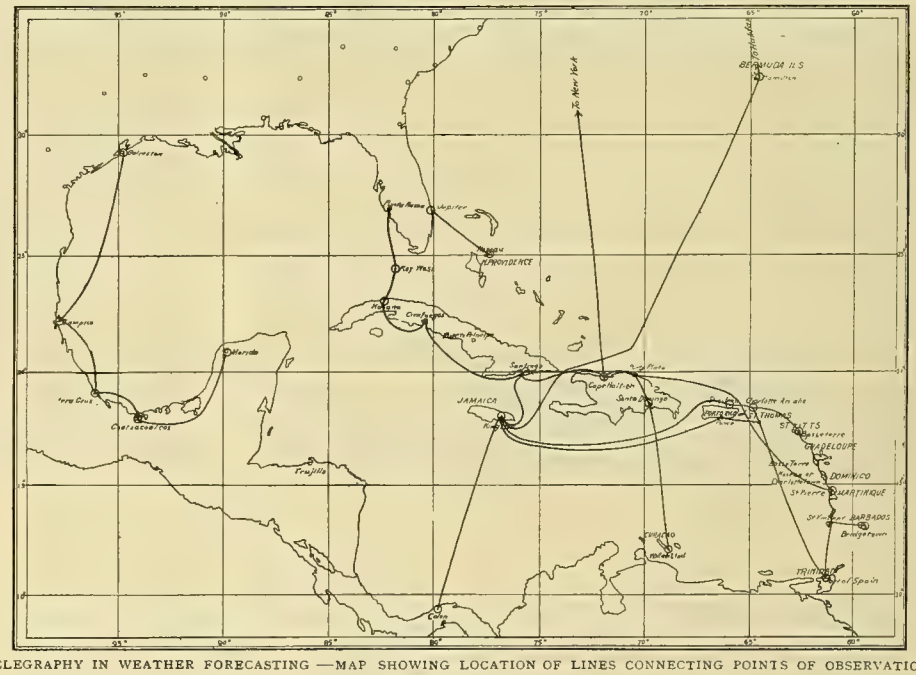
"A thorough inspection of the three stations of the Mexican Telegraph company was recently made by an official of the Weather Bureau. As a result the service was much improved and the system of observation brought into much closer harmony with our own.

"Thus it will be seen that ample provision has been made to extend the network of existing stations to the southward so as to include all of the dangerous waters of the West Indies, the Caribbean Sea and the Gulf of Mexico.

"Although the protection of our naval forces was the primary object in the extension of the storm-warning system to the West Indies, other considerations of scarcely less importance made the step a wise and beneficent one. First and foremost of these was the very material strengthening of the storm-warning system of the Gulf and South Atlantic coasts that would result from an extension of observing stations to the northern coast of South America; second, the improvement in the existing service that would follow the substitution of skilled observers for special agents in the West Indies, and, finally, the need of an efficient storm-warning service for the benefit of commercial interests throughout the West Indies and on the shores of the Caribbean Sea."

Senor Mariano Barcena, director of the Central Meteorological and Magnetic Observatory of Mexico, announces that steps have been taken to thoroughly equip about 30 stations in the Mexican republic with meteorological instruments of the most approved pattern, and to establish a meteorological service similar to the American bureau.

Interest in these undertakings is stimulated by the result of the war, which has brought this country into closer relations with Cuba and Porto Rico, and made the commercial interests of the United States in the West Indies of so much greater importance. The Weather Bureau has prepared a chart showing the location of the submarine cables employed in this service, the points connected and the territory covered, which is here reproduced from the Monthly Weather Review, together with the following report on the "Telegraph Service with the West Indies," by J. H. Robinson, the chief of the division:



TELEGRAPHY IN WEATHER FORECASTING —MAP SHOWING LOCATION OF LINES CONNECTING POINTS OF OBSERVATION IN THE WEST INDIES.

"Daily telegraphic weather reports from the West Indies, Central and South America, and the Mexican Gulf coast are now received at the central office of the Weather Bureau, i. e., from Nassau, Havana, Santiago de Cuba, Kingston, Santo Domingo, San Juan, St. Thomas, St. Kitts, Dominica, Martinique, Barbados, Trinidad, Curacoa, Colon, Coatzacoalcos, Vera Cruz, Tampico, and from Merida, when the conditions are threatening. Daily reports are also received from Bermuda. For details as to routes of submarine cables over which reports are transmitted, see the accompanying map, showing points at which the cables connect with the land lines.

"During the entire duration of the recent war with Spain daily weather reports were regularly received at the central office of the Weather Bureau from Havana. The observations were taken by the ob-

servers of the Spanish Meteorological Service for the Antilles, and were telegraphed by their operators to Key West, where they were retelegraphed to Washington. The submarine cable from Key West to Havana remained intact during the entire war, as did also the cable from Santiago de Cuba to Kingston, Jamaica. As the Key West-Havana cable had its outlet through the United States, it was not deemed wise to disturb it; the Santiago de Cuba-Jamaica cable, however, was grappled for, but not caught.

"In connection with this article, perhaps it would be of interest to know that the Weather Bureau observers of the sea coast in many instances rendered efficient service to their country by reporting passing vessels, one of the most important being the arrival of the Oregon off Jupiter, Fla."

Equipment of the Broadway Cable Line with Electricity.

[From the Scientific American.]

In recent issues of the Scientific American we have described at considerable length the important changes which are being made in the great system of surface roads owned and operated by the Metropolitan Street Railway company. These changes include the construction of four important north and south lines of railway on the underground trolley system on Second, Fourth, Sixth and Eighth avenues, with connecting cross lines at Fifty-ninth and Canal streets, the changing of the Broadway and Lexington avenue lines from the cable to the underground trolley system, and the equipment of a crosstown line from the Hudson to the East River with compressed air motors. When the work now in hand is completed, 90 miles out of the total of 228½ miles owned by the company will be mechanically operated. In the course of time it is intended to apply electric traction to the whole system, with the exception of some crosstown roads.

The electric roads are entirely new construction, the old horse-car tracks having been removed in toto to make way for the cast-iron yokes and massive 107-pound rails, which are the standard construction for all the new electric roads. On the Broadway road, on the other hand, the whole of the original track construction is available, and the changes are confined to laying of the cable ducts and bolting the conductor rails to the lower flanges of the slot rails within the conduit.

The ducts are laid in a trench which is excavated at the side of the tracks and slightly under them. Two kinds of duct are used, one consisting of riveted sheet-iron pipe about four inches in diameter, lined internally with cement, forming the top layer of 20 pipes, the other being made of terra cotta in short lengths of about two feet.

EQUIPMENT OF THE BROADWAY CABLE LINE WITH ELECTRICITY.—LAYING DUCTS IN BROADWAY.

EQUIPMENT OF THE BROADWAY CABLE LINE WITH ELECTRICITY.—DETAILS OF CONSTRUCTION.

The object of these numerous ducts is to carry independent conductors to different sections of the road, providing current in case of accident to one section to all the others, reducing to a minimum the possibility of delay on long stretches of road at a time.

The terra-cotta ducts are preferred for the high-tension current cables. In laying the ducts, the bottom of the trench is leveled and covered with from four to six inches of concrete. The ducts are then arranged symmetrically in layers and cement grout is run in between them to fill up the voids and bind the whole mass together. The sides and top are also concreted in, thus insuring that the continuity of the several lines of duct shall be preserved unbroken. The work of transformation is going on without the least interruption to the regular cable traffic.

The conductors consist of two lines of T-shaped rail, weighing 21 pounds to the yard, which are suspended below the cable slot by means of insulators attached to the lower flanges of the slot rails. The insulator consists of a circular cast-iron cup, provided with lugs by which it is bolted to the slot rails. Within this cup is another of porcelain, which is held firmly within the cast-iron cup by cement. The porcelain cup holds a 1½-inch wrought-iron shank to which the conductor T-rail is bolted.

To enable the conductor rails and their supports to be put in place, two handhole boxes are being placed, one on each side of the slot, at every 15 feet of the Broadway track. The conductor rails will be in 30-foot lengths, so that it will be possible to slide them into the conduit at the handholes. They will be supported at the ends and at the middle. After the insulators and conductors have been passed in through the handholes and bolted up and the wiring to the cables in the ducts completed, the Broadway road will be ready for the electric cars, which will commence running early in 1899.

The present Broadway cars can be utilized by equipping them with motors, and replacing the present grip by an electric plow. It is probable, however, that new and larger cars of the type at work on the present electric roads of the company will be supplied for this, the most important artery of travel in New York city.

In the underground trolley system, as now being installed, the track rails play no part in the electric circuit. The current is conveyed to and from the motor by means of the plow, one side of the plow receiving the current from the feed conductor and the other side delivering it to the return conductor. The shank of the plow consists of three steel plates, the outer plates being one-eighth inch and the inner plate three-sixteenths inch in thickness. The conductors, which are wrapped copper ribbons, are carried down through the plow to the contact shoes or wipers, connection being made between them by flexible cables. The shoes are of cast-iron and measure four inches by one-half inch. They are kept in contact with the conductor rails by means of side steel springs which keep the shoes eight inches apart when free and six inches apart when they are in contact with the conductor rails. It has been found that a pressure of about six pounds is sufficient to insure good electrical contact between shoes and conductors.

Under the slot is the sheet-iron drain tube and to the right another form of terra-cotta ducts, each section having four tubes about six feet long. By comparing it with the Broadway road it will be

[*Continued on page 374.*]

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK

CIRCULATION, 20,000.

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One feature of the holiday illumination of the great retail houses in Chicago that must have impressed the critical observer was the failure of many concerns to make any attempt whatever at securing artistic effects. Some of the most expensive displays consisted of a jumble of dry-goods, toys, clothing and similar articles, all costly in themselves, but arranged without any taste whatever, and the introduction of electric light without the slightest consideration of the effect produced. With the same material and profusion of light experienced window dressers would secure much more attractive results. The contrast between windows that were arranged with care and those where no definite plan was followed and no attention was given to details was so striking that the most careless observer must have noticed it. The people appreciated the difference, as was plainly indicated by the throngs which gathered where attention had been bestowed upon the arrangement of the display. The importance of these illuminations is growing in proportion to the increase in the use of electricity for this purpose.

The death of R. T. McDonald, which is chronicled this week, removes another active and aggressive member of that band of pioneers who recognized the advantages of electricity over other illuminants long before it became an important factor in the commercial world. Mr. McDonald was tireless in promoting the interests of the enterprises with which he was identified, and he was resourceful, too. His career was eventful and his success was gained almost entirely by his individual efforts. He wielded a powerful influence in the industrial, financial and political world and his death, coming as it did, while he was engrossed in commercial transactions, was indeed a tragic ending of his busy life.

So many objections have been urged against the plan of the Rapid Transit commission of New York for a tunnel railway system, that it was thought impossible to raise new ones, but it seems the commissioners themselves have been considering a new feature that will doubtless increase the opposition to the entire scheme. It is said that a bill has been prepared and is now under consideration which provides for the establishment of a big plant, which will enable the commission to sell current for commercial purposes. The bill may be presented at the opening of the Legislature. It will no doubt be opposed by existing companies engaged in selling electricity for lighting and power purposes, and also by the Manhattan and Metropolitan companies, which are contemplating similar plans.

Statistics are presented on the cost of operating street railroads in New York and Chicago in a paper read at Stevens Institute by Arthur J. Wood. While the electric conduit roads are operated in New York at a cost of 10.23 cents a car mile, in Chicago the cost for trolley roads is 13.051 cents. The cable roads in New York cost 16.35 cents a car mile to run, while in Chicago the cost is only 10.706 cents. In Connecticut nineteen trolley roads, each of which carries more than a million passengers a year, show an average working cost per car mile of 13.83 cents. Mr. Wood contends that New York can afford to build electric conduit roads, but for other cities the cable is cheaper. Mr. Wood is just about 10 years behind the times. This question has been settled by the street-railway men of the country, and as a result of the experience of the ablest managers, the cable is no longer considered as a factor in the problem. The men who are now operating cable lines would gladly discard that form of equipment, but they do not wish to put in a conduit system if they can persuade the people and the city councils to permit the use of the overhead trolley.

The year is closing in a much better financial condition than was anticipated a short time ago, although it may not fully meet the expectations of the opening months. R. G. Dun & Co. declare that "it is a year beyond parallel and goes to its close with the biggest volume of business ever seen. Enormous transactions at the stock exchange make some difference, and heavy railroad earnings, but when all the transporting and speculative interests are eliminated there is still a much larger business than in any other month of any year. Last month the exports were in volume greater than in any previous month in the history of the country, but this month the three weeks' report shows an increase of 25 per cent., against 9 per cent. in imports, which would indicate much more than $70,000,000 excess of exports for December. The manufacture has been much expanded by increased demand, so that prices of nearly all the goods quoted in our report have advanced more or less. The story of the iron manufacture is like a dream." Bradstreet's weekly review says: "Current business conditions furnish some sharp contrasts to those usually looked for or reported at this season of the year. It is, of course, reasonable to look for exceptional activity in holiday and retail trade generally at this date, and in this respect the most sanguine expectations appear to have been realized. Probably never before at this date, however, was the course of general business so animated as it is at present."

It is gratifying to note that the electrical interests of the country have participated in this prosperity, and that the industry at the present time is on a much more substantial footing than it was at the opening of the year. In many lines, particularly in the independent telephone field, the improvement has been so marked as to be beyond all comparison. The magnitude of the independent telephone business at the present time cannot be appreciated except by those who are in close touch with that industry. In central-station and street-railway work there has been notable improvement. Altogether the year has been prosperous.

The Western Electrician congratulates its patrons and, in wishing them one and all a happy and prosperous New Year, cannot refrain from expressing its gratitude for the loyal support it has received and the encouragement that has been extended it on all occasions by the electrical fraternity.

And now comes a day of reckoning. The war is over, peace is proclaimed and the time has arrived for a general settlement. Among the claims for damages presented against the United States are those which were sustained by the telegraph companies whose cables were cut by direction of Admiral Dewey and Admiral Sampson. The treaty of peace provides that each country shall settle the claims of its own citizens for damages growing out of the war, but no provision is made for citizens of other countries whose property may have been damaged or destroyed in the conflict, and it is presumed that such claimants must look for satisfaction to the country which actually inflicted the injury.

The English corporations which own the submarine cable lines in the Philippines and the West Indies have already presented their claims to the United States, and the British government has promised to urge the matter on behalf of the claimants. There are several points involved, however, which must be determined before any settlement can be effected. In the first place, the status of the telegraph companies and the property destroyed must be judicially determined. It is admitted by the Eastern Extension company that its cable at Manila was in possession of the Spanish governor, and that it was used for transmitting intelligence of great importance to the Spanish government and intended to be used against the United States. A similar condition prevailed in the West Indies. Both the Cuba Submarine Telegraph company and the West India and Panama Telegraph company have admitted, or rather boasted, that the lines between Cuba and Spain were kept open and even used by the Spanish government in directing operations against the forces and fleet of this country. It is contended that this fact alone precludes the possibility of the telegraph companies establishing valid claims for damages.

Many English authorities recognize the advantage of the United States should the government decide to set up the plea that the cables were seized and destroyed as contraband of war, because they were being used to aid the enemy. "Contraband of war" is defined by Wharton as being "that which, according to international law, cannot be supplied to a hostile belligerent except at the risk of seizure and condemnation by the aggrieved belligerent." This may very easily be construed so as to cover the cables and instruments used in supplying information to a hostile belligerent. The fact that the Cuba Submarine Telegraph company, which is the principal claimant, has enjoyed a subsidy of $10,000 annually from the Spanish government may also have a bearing upon the situation.

Another feature of the controversy is the authoritative announcement that in spite of the hacking and cutting of cables in the south of Cuba, communication with Madrid was maintained continuously until the American army occupied Santiago. The Cuba Submarine company declares that although many of its cables were destroyed, it was able to maintain at least one working cable to Jamaica through the entire period of hostilities. The West India and Panama company corroborates this statement, and now comes additional information on this point, in the report of the Weather Bureau, that the service of that department was maintained constantly between Santiago and this country over the lines of the Cuba and West India companies. So it seems that in spite of all the dangers to which the American sailors were exposed in the cable-cutting expeditions on the southern coast of Cuba the object failed of realization.

Death of R. T. McDonald.

The announcement of the death of Ranald Trevor McDonald of Fort Wayne, Ind., at Dallas, Tex., on Saturday, December 24th, will be received by the entire electrical fraternity with surprise and pain. It was not generally known that Mr. McDonald was ill, as he appeared in good health and spirits when he started South less than three weeks before his death. He left Fort Wayne for Dallas on the evening of December 8th, after spending two or three weeks at his home attending to the affairs of his several business enterprises. The first intimation received in Fort Wayne that he was ill was on December 18th, when a telegram to H. J. Miller, secretary of the Fort Wayne Electric corporation, stated that Mr. McDonald was suffering from a cold, but serious results were not anticipated until the following evening, when a second telegram announced that he was confined to his room. Wednesday night, December 21st, a telegram from Mr. McGrath, representative of the Fort Wayne Electric corporation in Dallas, requested that Mr. McDonald's family physician start immediately for that city. On Thursday morning, Mrs. McDonald, in company with Dr. Myers, left for Dallas, arriving there on Friday, December 23d. Mr. McDonald seemed to be in no danger and Mrs. McDonald notified relatives and friends of that fact. On the day of his death Mr. McDonald's family at his bedside did not anticipate that the end was so near. Many telegrams had been sent from Fort Wayne, inquiring about Mr. McDonald's condition, and the replies indicated, in a measure, the suddenness of the attack which finally carried him off. The first telegram from Mrs. McDonald stated that her husband was better. Shortly before noon a telegram to H. J. Miller from Mr. McGrath announced that Mr. McDonald was much better and another bulletin of his condition would be sent at two o'clock, but the next telegram came before two o'clock, and it contained the news of Mr. McDonald's death. Later news confirmed the first report and it was ascertained that grip and pneumonia, with other complications, were the cause of death. Mr. McDonald's body was brought to Fort Wayne, where the funeral was held on Tuesday.

Mr. McDonald was closely identified with many enterprises in Fort Wayne, the principal one being the electrical works, which he had built up in that city. He was likewise interested in electrical enterprises at St. Louis, New Orleans, Dallas, Indianapolis and New York. He was also one of the owners of the Hoffman House property in New York. The manufacturing enterprises in which he was particularly interested were the Fort Wayne Electric corporation and the Fort Wayne Lamp company.

Ranald Trevor McDonald was born June 24, 1849, in Allegheny City, Pa. He was of American parentage, but of Scottish descent. The family settled in Fort Wayne in the early 50's. In the Civil War he was at the front as a drummer boy, and when he returned to Fort Wayne he began life again as a clerk in a dry-goods store. Later he became a partner in the firm of Evans & McDonald, wholesale merchants of dry goods.

His first experience in electrical matters was gained in 1880, when he investigated the field for electric lighting, and becoming convinced of the advantages of the system, he assisted in 1881 in the establishment of the Jenney Electric Light company, to manufacture electric-lighting apparatus in Fort Wayne, under the Langley patents. His original associates were H. G. Olds, Oscar Simons, C. L. Olds and John P. Evans, and later J. H. Bass and P. A. Randall. Of this concern he was the leading spirit, a director from the start, and general manager. The Jenney patents were bought in the spring of 1882 and on October 2d of that year manufacture of lighting apparatus was begun on a small scale. In 1887 the Slatterly patents were acquired for alternating incandescent lighting, and the manufacture of the apparatus was begun under them. In 1888 fire destroyed the entire plant. Temporary quarters were at once procured in the shops of the Kerr-Murray Manufacturing company. In July, 1889, the old works had been reconstructed on a larger scale than ever, and the company, under the name of the Fort Wayne Electric company, resumed operations. In 1890 a branch factory was opened in Brooklyn, N. Y., but removed a year later to Fort Wayne, and was merged with the parent plant; the manufacture of motors, power generators and the Wood alternating arc-light apparatus was then begun. The plant had to be extended to accommodate the business.

One of the most interesting events in the history of the Fort Wayne enterprise was its temporary amalgamation with the General Electric company, in 1890. On January 3, 1893, fire destroyed several buildings. This fire brought up a new question. Mr. McDonald had made it a condition in his deal with the eastern capitalists that the shops should remain in Fort Wayne; but they proposed that the industry should be re-established in Schenectady, N. Y. An obstinate contest took place over this proposition. Mr. McDonald finally threatened to resign and to break away from the General Electric company. The General Electric people then made a diligent effort to get control of the stock. To protect the Fort Wayne stockholders, Mr. McDonald threw the company into the hands of a receiver, broke away from the trust, and organized the Fort Wayne Electric corporation, with a capital of $1,500,000, to take over the business of the old company. This settled the controversy, and from that day the Fort Wayne corporation operated independently. The burned buildings have since been rebuilt and added to and the plant now has a payroll larger than ever before in its history.

Mr. McDonald was happy in his home life. He was married in 1876 to Lillie Morse, a daughter of Marquis and Elizabeth Morse, at Angola, Ind. Their first child, a son, died in infancy, and the only surviving child is a daughter, Esther. His mother and sisters reside in Cleveland, and one brother, John D. McDonald, lives in Indianapolis. His sisters are Mrs. Gertrude Ramsey and Mrs. Belle Holliday.

He was a member of the Fort Wayne Club, and also of the New York and Chicago clubs, the Pickwick and Harmony clubs in New Orleans, and several other social organizations in different places.

He was a thirty second degree Mason, a member of Fort Wayne Commandery, Knights Templar, of the Mystic Shrine, Indianapolis Consistory, and a charter member of Fort Wayne Lodge of Perfection, Scottish Rite. Mr. McDonald never sought office, but he wielded great political power, and his influence in Indiana politics was sought by those desiring positions. His townsmen testify to his sterling worth and unusual ability, and Fort Wayne feels keenly the great loss it has suffered in his death.

RANALD TREVOR M'DONALD.

Michigan Electric Railways.

[Special correspondence of the Western Electrician.

Detroit, December 24.—Railroad Commissioner Wesselius has sent out a report from the state capitol announcing that railroad construction in Michigan during the year 1898 will include 200 miles of track. Most of this is made up of electric roads, which are springing up in all parts of the state. The following enterprises have filed articles of incorporation during the year: Rapid Railway company, capital, $1,000,000, to build from Clinton, Gratiot County, to Port Huron, 48 miles; Toledo and Monroe Railroad company, capital $450,000, to build from Toledo to Monroe, 22 miles; Pleasant Bay Railroad company, capital $100,000, to build from the Ohio state line to Otter Creek, 10 miles; Detroit, Plymouth and Northville Railway company, capital $250,000, to build from Wayne to Northville, 15 miles; Detroit, Utica and Romeo Railroad company, capital $300,000, to build from Detroit to Romeo, 30 miles; Grand Rapids, Belding and Saginaw Railway company, capital $350,000, to build from Greenville to Hastings, 44 miles; Wisconsin, Michigan and Northern Railway company, capital $130,000, to build from Faithorn to Quinnesec, 16 miles.

As yet the electric roads are under state jurisdiction only in a general way, but at the coming session of the Legislature the railroad commissioner will try to have them placed under his supervision the same as steam roads.

The local street-railway fight is over for the present. Nothing has been done and the matter coming up again there is little likelihood of for several years. Vice-president Hutchins submitted a franchise before the Common Council committee on street, which was referred to the council and then permitted to die.

The Detroit, Ypsilanti and Ann Arbor Railway company has opened up an office and waiting room on Griswold street, near Fort. The company has decided to defer putting down a double track for some time. The cars of the Detroit, Plymouth and Northville Railway company will connect at Wayne with the Detroit, Ann Arbor and Ypsilanti railway, thus making through connection for Detroit.

The Detroit, Plymouth and Northville Railway company began running cars Christmas week. Owing to the non-arrival of supplies, the company was considerably delayed.

Winter trolley parties are becoming a feature of the Detroit, Lake Shore and Mount Clemens line.

Niagara Power Company Upheld.

The Divisional Court at Toronto, Ont., on December 20th, handed down judgment in favor of the Canadian Niagara Power company, in the case submitted to the Crown as to whether the agreement with the Crown should be declared forfeited because of the failure of the company to have completed water connections for the development of 25,000 horse power, and have actually ready for use, supply and transmission 10,000 developed horse power by November 1, 1898.

Two men held up a street-car in Tacoma, Wash., in the outskirts, and robbed the conductor and motorman.

DEVELOPMENT OF THE TELEPHONE FIELD.

Listening and Ringing Equipment for Switchboards.

By H. P. Clausen.

Wherever a considerable number of telephone circuits are terminated at a centrally located point, some means other than mere lever switches must be employed for connecting together the different circuits, and it is only natural that a flexible means, such as a pliable conductor, with switching arrangements at the terminals, should be selected as the means for connecting together the telephone circuits; therefore, the general practice has been to terminate the telephone line in devices connecting to such signal receivers as might be necessary for enabling the telephone user to attract the attention of the switchboard operator. The latter, by placing what is commonly known as the switchboard plug into the calling subscriber's line-jack, cuts the signal-receiving device out of circuit, thereby rendering it inoperative during the time that the plug remains inserted. With a plug at each end of a continuous flexible conductor two telephone lines may be connected, and the telephone users may then remain in communication until either or both of the plugs have been removed from the line-jack. Such a plan, of course, would be the most efficient way were it not for the fact that after an operator connects two subscribers' telephone circuits, some means must be provided for allowing him to determine when they have completed their conversation. This brings out the point where a listening-in equipment is required. On some switchboards this equipment consists only of a spring-jack connected in circuit with the connecting cord, and for isolated, unimportant systems this plan will answer. Where several connecting cords are placed on the switchboard each is equipped with the listening-in jack. The operator's equipment consists of a separate plug connected by a cord with the switchboard operator's telephone and call-transmitting apparatus. In some cases the local-telephone and call-transmitting apparatus is in reality an ordinary telephone, placed alongside of the switchboard, and the plug is connected to the telephone-line binding-posts. With this equipment, however, when it is desired to ring up a subscriber, the telephone receiver must be replaced on its hook-switch, and a calling current sent out over the called subscriber's line by driving the telephone generator. Such an equipment will answer very well in small systems, say up to 15 or 20 subscribers' capacity switchboard. A variation from the plan may be effected by having the switchboard equipped with a complete speech-receiving and transmitting set, which is normally connected to the operator's cord and plug, which in turn may be connected to the switchboard generator, either by a push-button or lever switch, thus allowing calling over a circuit without any other act than the pressure of a button while driving the magneto-generator. This arrangement is used with marked success on toll boards, and in some cases on switchboards to which 50 or 75 subscribers are connected; however, when an operator is obliged to attend to a hundred or more subscribers, some arrangement must be provided which does not necessitate the withdrawal of a plug until the caller's needs have been satisfied, which he makes known by signaling for a disconnection. At this point provision must be made for what is ordinarily known as the circuit-changer. The circuit-changer is a device which allows either the operator's telephone circuit or the operator's calling apparatus to be connected to the cord circuits; in order to do this and give a satisfactory service, it is necessary to provide an arrangement which calls for a movable contact between both plugs of a pair. In the metallic-circuit system these contacts are numerous. Referring to the cut we have a diagrammatic representation of the elements required for constructing what may be called a circuit-changer. The plug C is connected to the contacts 1 and 2 by means of the wires T and S. The plug A is connected to the contacts 3 and 4 by means of the conductors S′ and T′. Tracing out the connections from the plug sleeve 12 C, over the conductor S, to the contact 1 and 1′, from the spring S C and S C′ to the contact 3′, from the contact 3 over wire S′ to the sleeve 14 of plug A; then from tip 13 back through the T′ conductor to the contact 4 and 4′, through the spring T C′ and T C, from contact 2′ and 2, over the conductor T to tip 11 of plug C; thus in passing we have had to cross eight surface contacts, or, including the sleeve and tip connection, 12, and as many more if we had followed the circuit through to both telephone instruments which might be connected to the above circuit. Attention is drawn to this fact in order to show that an absolutely reliable class of construction should be employed in constructing the circuit-changer, for every additional contact introduces just so many additional chances for probable troubles. In operating we have still more contacts to deal with; thus, while listening in on a circuit the button L is depressed, which, in effect, connects together the surfaces 7 with 7′ and 8 with 8′. In calling out through the C plug, the button C R is depressed, which connects the S C′ spring with the contact 10 at 10′, this connection when established allowing the current which is generated by G to flow out over 11 and 12 of the C plug. If it is desired to project a calling current over the A plug, the A R button is depressed, causing the S C spring to make contact with 5 at 5′ and T C spring to make contact with 6 at 6′. It will be observed that in both operations the cord which is not to be rung over loses its connection with the C and C′ springs before contact is made with the terminals, which connect to the call transmitter, and remain disconnected just so long as the ringing button remains depressed.

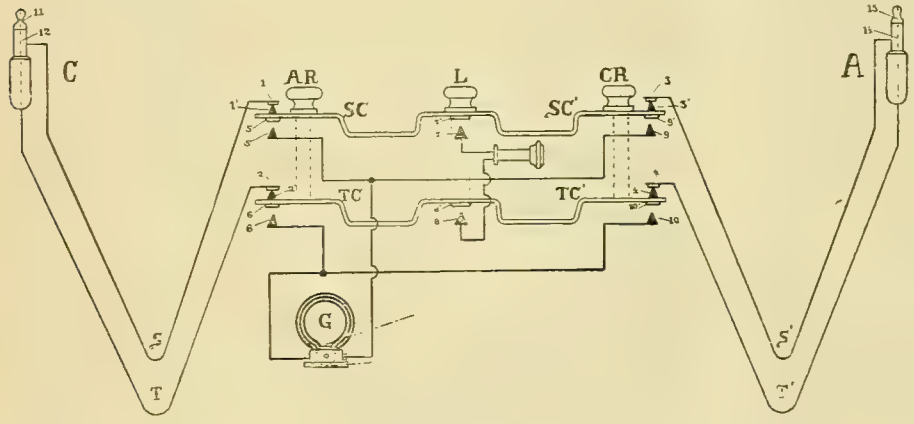
In practice the important connections of the circuit-changer which require special care in making are those which conduct the telephone currents. At its best a spring contact, such as is maintained at 1, 2, 3 and 4, is not any too reliable; therefore, in order to be assured that they will remain in constant contact, it is necessary that these connections should be made by an absolutely non-corrosive metal. Platinum is a metal whose equal as regards non-corrosiveness has yet to be found. The contacts 5, 6, 9 and 10 are not as important, for there generally is a strong enough pressure maintained by the generator G for forcing the required amount of current through the contacts, even if they are not bright and clean. The contacts 7 and 8 must, of course, be thoroughly reliable and they should be made by platinum surfaces. In maintaining contacts such as are shown at 1, 2, 3 and 4 the greatest difficulty is encountered through accumulation of dust, fine strands of cloth and other substances which settle around the contacts in such a way that their permanence is destroyed rapidly, the dust building up, so to speak, little by little until the resilient spring C does not restore the connection; therefore, it is important that no matter how well protected the contacts of the circuit-changer may be against the entrance of dust or fibrous material, the contacts must be made so that a considerable quantity of foreign substances may collect around the contacts without interfering with the actual connecting points. Dust naturally settles on the upper side of a surface; therefore all contacts placed on the upper side of a spring should be drawn to a point, whereas the under surface of a contact may be flat; thus it will be observed that a considerable quantity of foreign material might collect around the platinum points without interfering in the least with their functions.

Another question which might be discussed with some profit is that of the external arrangements of a circuit-changer. These arrangements are provided for ringing out over either of the cords and for listening in on both of the cords in conjunction. For toll-line switchboards this matter is easy of solution, as an operator must necessarily spend considerable time in transmitting calls and waiting for a response after calling. It is the universal practice to connect at least eight or 10 subscribers to every toll line, making code signals a necessary evil. There is also considerable time consumed awaiting responses, and obviously the listening in should be done without any exertion on the operator's part. The ringing equipment should be arranged in such a way that either long or short rings can be projected over the circuit without requiring a stoppage and restarting of the calling generator.

In systems where an operator is required to attend a large number of subscribers the problem assumes another aspect, for the operator cannot afford to spend as much time in ringing out or listening in as on the toll board. In the smaller systems, however, it is not good policy to introduce a very complicated circuit-changing equipment. An arrangement like that shown in the cut would answer with the possible exception that some provision would be required for allowing the operator to lock the listening button L into a position for listening without requiring to be constantly held down. The ringing button might be adopted as shown, one button for calling out on the answering plug and another for calling out on the calling plug. Going a step farther and arriving at the larger exchange systems, say, from 600 to 800 subscribers up, especially when the operator is required to serve 100 subscribers, the circuit-changing equipment cannot be made too complete a piece of mechanism. The listening-in equipment must be arranged in such a manner that the operator can listen in and allow the lever to automatically restore itself or remain depressed for any length of time, without any appreciable effort on the operator's part. The ringing equipment should be such that the operator may ring out either on the calling plug or on the answering plug without removing her hand from the listening button in order to do so. The operation preferably should be a back-and-forward movement. The listening-in movement might be a sideway motion, the calling-out movement a backward pressure, and calling on the opposite plug to be done by drawing the key forward. Another question of considerable importance is whether it is necessary to provide this latter movement, that, is, calling back on the caller's line. It seems to have become necessary, through the carelessness of telephone users, yet, when provisions are made for this movement, it adds just so many contacts, as are shown by the C S and C T springs at 1, 2, 5 and 6 in the cut. The provision for ringing both ways is of no considerable value to an operator. True, in the older switchboards with a series type of clearing-out drop the provision for ringing out on the answering plug was of value, as it allowed the plug to be employed for testing out a circuit to ascertain whether it were open or closed, which was determined by noting whether or not the clearing-out drop fell when ringing out. The writer does not expect to see this ringing-back feature dropped entirely, but he does believe that with these four additional contacts done away with, which in a 1,000-capacity system means a saving of about 500 contacts, the service would be much improved, and he does not see where any seriously detrimental results would be encountered.

Another class of listening-in devices is that which is automatic in operation, that is, when an answering plug is removed from its seat, a socket contact contained therein automatically connects the plug circuit to the operator's telephone circuit; thus by the movement of inserting the plug into the caller's jack the operator is placed in direct communication with the caller, and, on learning his needs, picks up a corresponding calling plug and while inserting it into the jack of the desired subscriber gives the plug a certain twist or forward pressure, which, in effect, momentarily connects the subscriber's line with a pair of wires constantly charged with current from an electric generator. In lieu of observing this device in practical operation (excepting in isolated cases) a reliable opinion as to its value cannot very well be given. However, the writer ventures to suggest that such devices are subject to more interferences than those which are encountered in an ordinary listening-in equipment, for, in the first place, the listening-in circuit depends on the calling plug of a given pair of cords for maintaining a reliable connection between the operator's circuit and the contacts which are actuated by a removal of a corresponding answering plug. Then, again, when the answering plug is inserted into a caller's line-jack the calling plug is relied upon to disconnect the operator's telephone circuit from the cord circuit. This feature in itself would appear to be prohibitive of rendering a satisfactory service, especially when it be considered that it is a hard matter to keep cords and plugs in their proper working order without introducing an additional arrangement in their sockets, which always depends on all of the cords, weights and plugs being in their proper working order. It is of value to note that a manufacturer of switchboards who furnished a device similar in a general way to that described has discarded the method and adopted a simple form of circuit-changer in its stead.

Taking the problem as a whole, the question of listening-in and ringing equipments is merely one of how few simple pieces of apparatus may be made to perform the required functions with the least possible number of parts and movements.



LISTENING AND RINGING EQUIPMENT FOR SWITCHBOARD

Overtures of Bell Company Rejected.

The policy of the Bell interests to placate the opposition wherever they find it difficult or impossible to crush it out has received a most emphatic set-back in Illinois and Indiana. The Paris, Ill., Daily Beacon of December 21st furnishes the following particulars of an interesting meeting at which this plan was summarily disposed of by the independent companies:

"Twenty-five representatives of independent telephone exchanges in Illinois and Indiana held a very important meeting in the hall of the Paris Hotel annex to-day. The visitors were entertained at dinner by P. G. Farrow, manager of the local exchange, and immediately entered upon the business in hand.

"The meeting was called at the instance of the (Bell) Central Union Telephone company to discuss a proposition looking to the interchangeable use of its lines with those of the independent companies. The Bell people failed to come to time, and had no representative at the meeting, which was called to order by the president of the association, Dr. I. A. Lumpkin of Mattoon, and the question of any prospective amalgamation with the Bell company was discussed with considerable interest.

"Finally, to test the sentiment of the meeting, a resolution was introduced by Mr. Ramsey of Crawfordsville, rejecting in the most positive and unqualified manner the overtures of the Central Union Telephone company and declaring that neither now nor at any future time would any proposition for the interchangeable use of lines be considered. This resolution was adopted with a whoop without a dissenting vote, showing very plainly the feeling of the independent exchanges toward their once powerful rival.

"A number of minor differences between exchanges of the association were brought up and amicably settled, the meeting resulting in much good along this line. Dr. Lumpkin urged upon those present the importance of attending the next meeting of the state association of the independent telephone men at Bloomington.

"Following is a list of those present at the meeting: J. H. Davis, O. C. Burton, W. S. Ashmore, E. P. Moffett, C. H. Langford, Z. E. Patrick, O. P. Chamberlain, George H. Hughes, J. G. Schance, George W. Fair, J. L. Horney, I. A. Lumpkin, C. I. Arterburn, H. C. Wilson, H. W. Beggs, S. P. Sheerin, W. W. Tobey, George W. Beers, A. F. Ramsey, P. G. Farrow, F. A. Brooks, L. O. Jenkins and I. J. Kusel. The exchanges represented at the meeting employ 9,720 telephones."

Row Over Telephone Poles.

Red Bank, N. J., December 24.—A warrant has been issued for the arrest of T. Forman Taylor, a well-to-do farmer, living near Colt's Neck, for cutting poles belonging to the Monmouth County Telephone company. Charles Atkinson, manager for the company, and a force of men went out to place poles along the Tinton Falls turnpike. Taylor drove up and chopped down a pole. One of the men grabbed hold of Taylor, who, it is said, drew a revolver. Before the scrimmage ended Taylor had succeeded in mutilating a number of poles. The telephone company claims that it has secured permission from the farmers to plant poles in front of their property, but Taylor, who is a member of the turnpike company, says that the latter owns the land on which the telephone company is trying to put up its poles. He also claims that the telephone company agreed to pay for the privilege of placing the poles at the rate of $10 a pole, and that the company has not lived up to its agreement. No poles will be placed on the turnpike by the telephone company until the present matter is settled.

Extensions and Improvements.

The recent storm, so the managers of the Detroit telephone companies declare, damaged over 5,000 instruments in that city. It is impossible, even at this date, to give an accurate account of the damage. Besides the loss of wires and poles, many telephones were burnt out, as a result of the crossing of the street-railway company's wires.

The De Kalb County Telephone company recently issued a directory of towns and telephone users connected with its lines. There are in the directory 30 pages of names of telephone users in De Kalb, Boone, McHenry, Ogle, Lee, Whiteside and La Salle counties. These subscribers live in 50 towns in the territory named, all having telephones in their own homes or places of business. Besides these there are 30 cities and crossroads where public telephones are maintained and where any resident may be reached by messenger. The McHenry County Telephone and Toll Line company of Woodstock, Ill., enjoys the same connections. This is a great system, and much of its effectiveness has been brought about through the untiring efforts of Wager & Joslyn.

The Indianapolis Sentinel of December 18th announces that the Bell company is knocked out, and that the New Long-distance company of that city has secured control of the Western Indiana Telephone company and the Jasper County Telephone company. A dispatch from Lafayette, Ind., December 17th says: "The most important telephone meeting ever held in the state was held at the Lahr House here to-day. The Bell company has been for some time endeavoring to get the control of the Western Indiana Telephone company and the Jasper County Telephone company, two organizations controlling a large number of exchanges and many miles of toll lines. The meeting to-day was for the purpose of considering and disposing of the Bell proposition, which was unanimously declined, and a 25-year contract was entered into with the Lafayette Independent Telephone company and the New Long-distance Telephone company of Indianapolis. The following-named towns and cities were represented: Rensselaer, Goodland, Fowler, Earl Park, Monticello, Wolcott, Brook, Morocco, Pine Village, Boswell, Ambia, Oxford, Kentland, Remington, Reynolds, Idaville, Burnettsville, Monon, Chalmers, Brookston, Otterbein, Attica, Williamsport, Covington, Watseka, Ill. The New Long-distance Telephone company was represented by S. P. Sheerin, A. F. Ramsey, H. B. Gates and George W. Beers."

Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Blue Earth Valley Telephone company of Winnebago City, Minn., denies a report that it has sold out to the Northwestern Telephone Exchange company.

A local exchange has recently been completed at Carthage, S. D.

Negotiations have been pending by residents of Rush City for the purchase of the village telephone exchange at Mora, Minn. The deal fell through and the Rush City people absorbed a toll line to Brunswick which had been working with the Mora exchange, and refused Mora telephone holders the use of it without paying toll. The connection was cut out of the Mora exchange and the line will be boycotted.

The County Board has rescinded its action to use instruments of the Northwestern Telephone Exchange company at Mankato, Minn., and ordered service from the new Citizens' company.

The Minnesota Mutual Telephone and Telegraph company's wires have reached Pine City, Minn. They will probably be extended to Duluth in the spring.

The Home Telephone company of Montgomery, Minn., declared a dividend for the last year of 40 per cent.

The Iowa Telephone company has been working to secure enough subscribers for an exchange at Columbus Junction, Ia.

The Mutual Telephone company is an applicant for a local telephone exchange at Pella, Ia. The franchise will be voted on soon.

The Bishop Telephone company of Central City, Ia., has increased its capital stock from $10,000 to $25,000.

The telephone exchange at Buffalo Center, Ia., has put in a new switchboard, with 100 drops.

John M. Baker, general manager of the Iowa Telephone company at Davenport, Ia., has recovered sufficiently from his illness to return to his office.

By January 1st the new telephone company at Fort Dodge, Ia., will have 240 instruments in operation.

A telephone line is projected to connect Ulen, Minn., with Detroit, Lake Park, Audubon, Voss P. O., and other points in Northwestern Minnesota.

The Standard Telephone company has about decided to locate an exchange in Caledonia, Minn.

A local telephone exchange will be established at Appleton, Minn., if 50 subscribers can be secured.

One of the aldermen of Mankato, Minn., thought the Citizens' Telephone company ought to furnish the city free service in return for the franchise which was recently given the company. The majority of the council did not agree and contracted for four instruments at current rates.

The Chatfield Telephone company of Chatfield, Minn., has made a traffic arrangement with the Northwestern Telephone Exchange company.

The Elgin (Minn.) Telephone company has poles set for the line to Plainview.

The new telephone exchange at Cascade, Ia., has opened for business, with 23 instruments in use.

Duluth, Minn., has begun to hear from prospective bidders for the telephone franchise. R. H. Evans of Detroit has made inquiries.

The telephone line between New Glarus and Blanchardville, Wis., has been completed. It will be extended to Monroe in the spring and probably to Dodgeville.

The suit of stockholders in the Electric City Telephone company of Great Falls, Mont., involving the transfer to the Rocky Mountain Bell Telephone company has been compromised. The terms are not known, but the Bell company will hold the property.

The Columbia and Northern Telephone company of Colville, Wash., has been incorporated, with $15,000 capital stock.

The Northwestern Telephone Exchange company is putting in long-distance transmitters for all business service at Mankato, Minn., without extra charge.

The Sunset Telephone company has been granted a franchise for an exchange at Hoquiam, Wash.

W. B. Aris has been granted a franchise for a telephone exchange at Kettle Falls, Wash. It is proposed to connect with Meyers Falls, Marcus, Davenport and other towns in the county. Work on the exchange will be begun at once.

Telephone connection will soon be completed between Spokane, Wash., and Helena, Mont.

The Duluth Telephone company has completed its toll line to Cloquet, Minn., and has formally opened it.

Telephony Abroad.

The Birmingham telephone exchange is now being reconstructed, and the subscribers are very impatient with the service. The essential alteration which is being made lies in the reduction of the number of local exchanges, so many subscribers as possible will be connected up to the head exchange, and a few local exchanges will also be enlarged to deal with larger groups of suburban subscribers.

The Liverpool Chamber of Commerce has resolved "that having regard to the present working of the telephone service under the dual control of the Postoffice and the National Telephone company, it is expedient in the judgment of this council that the government should acquire the undertaking of the National Telephone company, limited, on terms just and reasonable as between the public and the company's shareholders."

At a recent meeting of the London Court of Common Council, the police committee was instructed to consider and report as to the desirability of placing the several police stations in the city upon the telephone service. It was a matter of surprise that that excellent means of communication had not been made use of in the metropolis in the same way as it had been by some of the more enlightened cities and towns in the provinces. With reference to the proposed conference of the metropolitan local authorities on the subject of the telephone service, the chairman of the streets committee said that a date had not yet been fixed.

Application has been made to amend British patents Nos. 8,607 of 1894 and 23,239 of 1897. Both patents relate to forms of automatic telephone exchanges, the former by A. E. Keith of Chicago and the latter by the Strowger Automatic Telephone Exchange. Particulars of the proposed amendments are to be found in the Patent Office Journal of December 7th, and notices of opposition must be lodged by January 7, 1899. The reason given for the desired amendment is that the patentee is advised that some of the claims as originally drafted are capable of being interpreted too widely, and that he desires to restrict them to the invention described.

The members of Glasgow Corporation recently inspected a direct-automatic telephone exchange, equipped by the Telephone Construction company of London. The exhibit in the Glasgow municipal buildings contained a miniature central exchange in full working order, and was approved by the committee. A contract has been made between the corporation and the Telephone Construction company, with the object of having an installation of 25 telephones placed in the municipal buildings. In place of there being a switchboard worked by girls in the central exchange, the connection is made by the subscriber himself through an automatic switchboard which is operated by means of a disk having numbers on its margin. The cost is about the same as the switchboard now in use, it is estimated, but nearly all intermediate labor is done away with, and claim is made that the necessity for repair is very largely minimized. It is not expected that a serious attempt will be made to furnish an equipment for the municipal exchange which it is proposed to establish in opposition to the National Telephone company. A letter appears in the North British Daily Mail from the Ericsson-Bell Telephone company on the alleged boycott of the anti-National promoters: "As you have published in your issue of December 2d our letter of November 25, 1898, to Sir James Marwick, the town clerk, Glasgow, withdrawing our quotations of September 23, 1897, for multiple switchboards, telephones, etc., we wish you to make it generally known that the contract made by Messrs. L. M. Ericsson & Co., Limited, at Stockholm, with the National Telephone company, Limited, London, was signed on October 3, 1898, at Stockholm, without our knowledge or consent. The agreement made is not to sell telephone apparatus to or for any municipal corporation, or any licensee of her majesty's postmaster-general, in connection with exchange lines within the British Isles, except through the National Telephone company, Limited, at London." The agitation provoked by this action seems to have startled some of those interested in the affair.

COMMUNICATION.

Public Service Telephones at Mankato.

To the Editor of the Western Electrician:

Your issue of December 24th contains an error in the statement in substance that the Northwestern Telephone company defeated the Citizens' Telephone company for the equipment of the county buildings. That company has had two instruments in the county buildings for some time. The county still retains them and adds six of the Citizens' company instruments. We don't feel very much defeated. The City Council also voted to substitute our instruments for the Northwestern's.

J. H. JAMES,
President Mankato Citizens' Telephone company.

Mankato, Minn., December 26, 1898.

Wireless Telegraphy in France.

W. P. Atwell, the commercial agent of the United States at Roubaix, has furnished the consular department the following translation of M. Ducretet's article on "Wireless Telegraphy" and the experiments now being conducted in France:

"The starting point was the discovery by Henri Hertz, in 1889, of electric waves analogous to waves of light. A machine invented by him enabled one to perceive the diffusion of electric vibration at a short distance.

"Professor Popoff, a Russian savant, was on the point of applying this discovery to telegraphy in 1895, when he learned that M. Branly, a Frenchman, had already invented the tube seen in my machine and which is the essential point, as this puts in motion the electric currents, or, to use the technical term, the inducting currents.

"M. Branly has not received the proper share of praise for his important invention. In 1890, he had already observed the action of electrical radiation on metal filings, free or agglomerated, placed in an insulator between two conductors forming a circuit made by a battery and a galvanometer. The filings, primitively insulated or of very high electric resistance, become conductors when they are struck by an electric wave. This conductibility is destroyed by a blow, but reasserts itself when the filings are struck by a new wave.

"M. Branly has given the name of radio-conductors to his tubes made of filings. This name suggests that their conductibility springs from the influence of electric radiation, produced by any source whatever. The sensitiveness of this transmitter is extremely great.

"Professor Popoff first used his own machine to register electric waves produced by atmospheric disturbances; he then demonstrated that it could be practically employed in the navy for long-distance signals. England immediately commenced experiments with a machine based on the same principles and with which, it is said, messages have been sent between Bournemouth and the Isle of Wight.

"Experiments have been made in Paris and quite recently at Brest, where Mr. Tissot has successfully communicated with a point 1,800 meters (5,905 feet) distant. I have covered a distance of four kilometers (2.48 miles), and the transmission was as clear, even through a fog, as between the Pantheon and my laboratory, Rue Claude Bernard. I have reason to believe that still greater distances will be compassed. The chief difficulty will be to find two points at sufficient distance and at the same time high enough not to be hidden from one another. The success that has crowned our efforts is due to the improvements I have made in the receiving machine and particularly in the Branly tube.

"It cannot be concluded from our experiments that Hertz telegraphy will take the place of ordinary electric telegraphy, but experiments already prove the value of this system for the exchange of signals between ships and the shore, for lighthouses and exploring service, and for communication in our colonies—African and Asiatic. In town, posts could be readily established by using windows or towers on high buildings very far apart. The only objection would be that all machines favorably situated would receive the telegrams from one transmitter. This would render telegrams public property, unless a secret alphabet were adopted.

"The receiving machine may be utilized for other purposes than communicating the current to a telegraphic machine; a row of incandescent lamps can be lighted, for example, or the fuse of a mine touched off. It is merely a question of sufficient force."

In further explanation of the work being done in France Mr. Atwell presents the following particulars:

"The experiments spoken of by M. Ducretet are now being carried on at his Paris laboratory. On the top of the building passers-by may see a mast 20 meters (65 feet) high. A wire passes along the top and is connected below with an electric conductor, a Ruhmkorff coil and an accumulating battery made after a special plan. The machine is set in motion by pressing on a handle. By manipulating this, a telegram can be sent as well as by an operator seated before his machine. It would seem that the message would stop when it reaches the end of the wire. This is not the case, for it is transmitted to a receiving machine four kilometers (2.48 miles) distant. To secure this transmission, there must be no such obstacle as an iron wall or shaft between the two points. A simple wall does not interfere for a space of several hundred meters.

"As soon as the transmitter is put in motion, the receiving machine—the ordinary Morse machine—begins to work automatically; the dispatch arrives as well as if a wire connected the two points. A bell rings to indicate the transmission of a message, but the paper rolls out automatically to receive the words printed by the Morse alphabet, and when the message is completed, the paper ceases to roll.

"The message is received through a garret window, from which hangs a wire. This wire communicates with the Morse machine through a box containing special machinery. As soon as the telegram starts this begins to tick, and an experienced telegrapher might spell out the telegram before it appears on the paper.

"For the use of specialists and for laboratory experiments, a small transmitter has been constructed which has no mast and no wire running above. In the course of experiments, this little box has even been disconnected from the wire hanging from the window, and the transmitter started. The same ticking began, and the vibrations were plainly felt by taking it in the hand.

"The box can be opened without danger and everything withdrawn. There will be found in it dry piles, small wire coils, and a little hammer that strikes on a tube when the current that transmits the telegram passes. The stroke of the hammer against the tube produces the ticking sound; and it is this tube, the essential part of the construction, that is the invention of M. Branly, a native of France. It is claimed in France that to this tube is due wireless telegraphy, both in this and other countries."

Early Experiments in Space Telegraphy.[1]

By Dr. Oliver Lodge.

I have at my house a cable a quarter of a mile long altogether, enclosing an elongated rectangle, say, 150 by 30 square yards, and with that I can hear all that goes on in the neighboring telephone wires, and can even answer back with a suitable microphone transmitter; but, there being, I suppose, no phonopore in the neighborhood, I hear no stray musical note; the only musical note I hear is the one belonging to the desired signals when they are being sent to me from an equal length of cable round an equal but squarer contour at the college about two miles away, or 2.5 kilometers in a direct line. I may say that, although the Leyden jar or condenser constitutes a leading feature of my system, I have occasionally, as an experiment, dispensed with it, and tried what could be done with the area enclosing circuits alone. But under those conditions, with the power I had at my disposal, I was not usually able to hear anything. I was using a small low-frequency dynamo of the Pyke and Harris pattern, and at the sending end had a current of 10 or 12 amperes going around the circuit, sometimes as much as 25 amperes. Under these circumstances, on the ordinary National Telephone company's telephones, the sound could be heard many miles away; away over in Cheshire, toward the Dee, the signals could be clearly heard, while close to the college the subscribers, unfortunately, became rampant; but through empty space the signals only became audible at a distance of two miles when a condenser was used and the circuit properly attuned. I am speaking now of the early trials when no suitable receiving telephone was employed, but only the first to hand. The cable, bought for the purpose of the trial, was described as anti-inductive telephone cable (not exactly the variety required), and it was very badly insulated, having been bought as little more than old materials; but still it might, perhaps, have been expected to do better. Directly the circuits were syntonized, however, there was no difficulty in hearing the note and the signals. I should say that I did not work with the fundamental frequency of the dynamo—128 per second, or thereabouts—but with the third harmonic, which is fairly strong in these Pyke and Harris alternators, of frequency 384. Such a note is pleasanter to listen to than a deep bass, the ear is far more sensitive to it; and, moreover, to attune the circuit to the lower frequency would have entailed a prodigious capacity. As it was, I used 28 microfarads, and had to insert the thick wire of a Hedgehog transformer in the circuit, too, in order to get the induced circuit frequency as low as 384 with the quarter-mile length of cable once round. I generally used a couple of Ader telephones in series, each of about 70 ohms resistance, and connected them thus as a shunt to the receiving condenser. The resistance of the receiving cable itself was only 0.07 ohm (it consisted of 100 No. 18 wires all in parallel), so that if the telephone had been in series with it a very low-resistance winding would have to be employed, and in the early trials I did not happen to have such a telephone handy. I did, however, use a Western Electric loud-speaking telephone of two ohms resistance occasionally. A transformer, of course, was sometimes used, but it wastes power. Besides, the low resistance of a transformer winding is apt to be rather illusory when its higher resistance secondary is closed. At the sending end, also, condensers were employed, in series with dynamo and coil, in order to strengthen by resonance the third harmonic at the expense of the fundamental. The cable there was about 400 yards of well-insulated telephone cable, consisting virtually of 20 strands of separately insulated No. 16 wire, slung on poles around a squarish contour; but, unfortunately, it was again sheathed in lead so as to be nominally "anti-inductive." I found it best usually to join these 20 wires in five series of four strands each; and the current in each strand being then, say, six amperes, I call the whole current in the cable 24 amperes. The receiving cable I could also at first employ in separate strands, for its 100 wires were supposed to be insulated with thin India rubber. The first time I heard the note I had 19 of these strands in series, without a condenser, constituting a coil of 19 turns, connected to an Ader telephone. Since then, however, the insulation has so much broken down that I am constrained to use all the wires in parallel, which, for many purposes, is not so convenient.

1. Abstract of paper read before the Institution of Electrical Engineers at London, December 8, 1898.

Massachusetts Institute of Technology.

President Craft's annual report of the Massachusetts Institute of Technology, presented at the last meeting of the corporation, shows that the year has been a remarkable one in the financial history of the institute. More money has been received through bequests and gifts than in any previous year. Under the will of the late Hon. Henry L. Pierce, $750,000 has been paid to the institute by his executors. This is the largest donation ever made to it by one person. In addition to this, the executors of the late Mrs. Julia B. H. James have paid over $140,500, this being also one of the largest gifts ever made to the institute. Mr. George A. Gardner has generously given $20,000, the income from which is to be used in the payment of salaries, a much needed provision, while $10,000 has come from the late John W. Carter, and $1,482.79 has been added to the large sum previously received from the estate of the late Mrs. Susan E. Dorr for the Rogers Physical Laboratory. Besides these gifts to the institute itself a traveling fellowship in the architectural department has been established by the will of Willard B. Perkins of the class of '72. For this purpose the sum of $6,000 has been given, the accumulated income from which is to be used every fourth year. The estate of the late Mrs. Ann White Dickinson donated $40,000 for scholarship purposes. A friend has given $500 to meet a special want, and $200 has come from Mrs. William B. Rogers, to be used for periodicals. This great increase in funds came at a time when it was very much needed. It at once led to the erection of the new fireproof building in Trinity place, which is to bear the name of the late Hon. Henry L. Pierce. It has also made possible extensive changes and improvements in the old buildings. It is expected that the institute will receive $400,000 from the estate of the late Edward Austin. This amount appears to be intended for scholarships and similar uses, and will be highly appreciated, but the great desideratum for the immediate future is accessions to the unrestricted funds of the institute. It is a fact not generally understood that the actual expense of instructing students is on the average $330 per year, while only $200 is paid as tuition fees. The balance of $130, including interest on permanent investments, land, buildings, machinery, etc., has to be met. During the year the institute has lost by death two of the oldest members of the corporation, Frederick W. Lincoln and John M. Forbes. The total number of students is somewhat diminished this year, being 1,171 as against 1,198 last year. For the last four or five years the number has changed very little. Statistics recently published in regard to all schools of applied science in this and other countries show that a maximum was reached in 1894, and that since that date the number of technical schools has increased, while the number of students has decreased. The figures given do not allow of very exact determination, but, so far as published, they show a very considerable decrease since 1894, so that, on the whole, the management considers that it has been fortunate. The report explains that such a pause as may be observable in the development of schools of applied science is not due to lack of demand for skilled professional knowledge, as experience shows that the demand is a constantly increasing one, and that where one man is sent out to take charge of any branch of manufacturing industry it frequently creates a demand for other men to take charge of other departments of the work. It has been found that 17 undergraduates and 61 postgraduates, as far as known, have taken part in the war. In the different departments the introduction of advanced studies in consequence of advanced entrance requirements shows that the school is making continued progress toward a higher standard for its degree. Another notable feature is the progress toward a greater subdivision of students into small sections in laboratories, and the consequently increasing value placed upon laboratory work. During the last four years this movement has led to the appointment of 18 new instructors, while the total number of students has remained about the same. The departments of civil and mechanical engineering, naval architecture, architecture, geology and industrial chemistry have benefited by the erection of the Pierce building in increased space, better light, and particularly in having rooms especially designed to meet the wants of these departments.

Equipment of the Broadway Cable Line with Electricity.

[*Continued from page 369*]

seen that the new track is considerably heavier The rails, weighing 107 pounds to the yard, are not only the most massive used in any street railway, but they are several pounds heavier than the largest rails used on the steam railroads, where the most massive rails do not exceed 100 pounds to the yard. This is the weight of the rails on main line of the New York, New Haven & Hartford railroad and on certain stretches of the New York Central and the Pennsylvania railroads.

Current for the whole of the underground system, including the Broadway line, is eventually to be furnished from one great central station at Ninty-

sixth street and the East river. It will have a capacity of 70,00 horse power, or over four times that of any existing power station in this country. The plant will consist of 87 water-tube boilers of 800 horse power each; 11 cross-compound engines, each of 6,600 horse power, and 11 direct-connected three-phase alternating-current generators. The current, at 6,000 volts, will be led to eight substations, conveniently located with reference to the various lines. Here it will be converted by static and rotary converters to a pressure of 550 volts, at which it will pass to the conductors.

Shortcomings of Municipal Ownership.

[From the Engineering Record.]

A favorite subject of discussion by a limited class of self-styled municipal reformers is the municipal operation of street railways in the United States. They point to the operation of such railways by a few municipalities in Great Britain as indicating greater progress in those cities in the direction of municipal control than anything yet achieved on this side of the Atlantic, and in other ways spread an opinion abroad that the United States is far behind the times. No one can truthfully claim that the control of semi-public undertakings in this country is not deficient in some respects, but the defects are as liable to be injurious to the corporations as to the cities, and the talk about municipal street railways is sadly misleading.

It has long been the British practice to own the street-railway tracks and lease them to private companies, the object of such a system being to secure as permanent and good streets as possible by keeping both track and pavement under city control. But until recently the operation of street railways by municipalities has been decidedly unpopular.

In 1882 Huddersfield, a city of about 100,000 population, began to operate a horse and steam road which is now 22 miles long. It is financially unprofitable, and the deficiency in revenue is met by taxation. In 1893 Plymouth, a slightly smaller city, found itself forced to undertake the management of four miles of horse tramway which would not be tolerated in an American village to-day; it also is a financial failure. The next city to follow this lauded procedure was Leeds, having a population of about 400,000, which operates 22 miles of horse, steam and electric lines at a slight profit. In 1896 Sheffield, with a population of nearly 350,000, began the operation of 10 miles of track with horses and steam motors of a type well calculated to make a traction engine shy. The financial returns on this enterprise are still uncertain, but there is reason to look for a profit next year. Dover and Hull began municipal operation of their lines in the same year, and in 1897 Birkenhead, Bolton, Bradford, Edinburgh, Halifax, Leicester, Liverpool, Manchester, Newport, Neath, Nottingham and Southampton obtained the same right from Parliament. During the past year several other cities have also been given power to operate railways.

The experiment in municipal operation which has attracted most attention is, however, that of Glasgow. In 1872 this city leased its street tracks to the Glasgow Tramway and Omnibus company, which paid $980,000 to the city on account of construction during the 23 years of the lease. The tracks cost the city $1,678,000 all told, but deducting the company's payments, the net cost may be roughly estimated at $698,000. The city paid out during this period as interest on the tramway debt and on the sinking fund about $1,083,000, while it received from the company $1,169,000 in the name of interest on the capital expenditure and $224,000 as mileage taxes, or $1,393,000 in all. The difference between $1,393,000 and $1,083,000, or the sum of $310,000, distributed over a period of 23 years, may be considered as approximately the net profit of the undertaking. When the lease expired on July 1, 1894, the city was thus the possessor of about 65 miles of track, which had cost it the net sum of about $698,000, and had to its credit in the "common-good fund," on account of the street railway, the sum of $310,000.

What the city has done since that time is not calculated to make an American want such municipal management. The committee of 25 which had control of the tramways could not agree on a system of mechanical traction, and, accordingly, decided to continue the use of horse cars. New barns were built, a large number of horses were bought, and new equipment of this class was secured throughout at a time when electric traction had been clearly demonstrated to be financially better, as well as more satisfactory to the traveling public. The net capital expenditure was increased from $1,678,000 to $3,066,000 by May 31, 1897, and if the $980,000 paid to the city by the old company is taken into account, it will be seen that $4,046,000 had been spent in all to acquire a system of 77 miles of single-track railway.

The total revenue for the fiscal year of 1897 was $1,805,000, and the total working expenses were $1.393,000. But of these expenses, $632,000 was spent for wages and salaries at rates about half those paid in the United States. For example, conductors and drivers were paid $1.08 a day after three years' service, while the West End Street railway was paying $2.25 for the same service; Glasgow paid switchmen 28 cents a day and the Boston company $1.14, and so on through a long list; so it is evident that while the Glasgow railways showed a profit under the existing conditions, if the men were paid American wages the balance would dwindle to an insignificant amount.

Electric traction was bound to come in Glasgow, however, and the city can now boast of owning and running an electric railway, although a very short one, 2½ miles long. It is thoroughly American, which must disturb those reformers who say Great Britain is the fountain head of wisdom in street-railway management, for the power plant comprises three 300 horse power McIntosh & Seymour engines direct-coupled to Westinghouse generators, two Babcock & Wilcox boilers, Westinghouse motors, Worthington condensers, Blake-Knowles pumps, and the latest American system of track construction with 100-pound rails resting on longitudinal beams of concrete. The fares on this electric line are one cent for .6 mile, two cents for 1.81 miles and three cents for 2½ miles, the length of the line.

Glasgow has a population of 700,000. In its present condition it operates street railways in 36 miles of street, there being over 73 miles of single track. Boston and its immediate suburbs have a population which may be roughly assumed to approach that of Glasgow, but this population was served by over 400 miles of street railways, mostly electric, in 1895, and the mileage has grown since then. Huddersfield and Plymouth together have 26 miles of railways, operated by horses and steam. Worcester, Mass., a city of the same size, has 60 miles of electric railway. Leeds has 22 miles of well-assorted classes of street railways, and Denver, Colo., about one-fourth its size, has 212 miles, mainly electric and cable, the latter now giving way to the former. In view of these facts, it will require more than glittering generalities to convince a citizen of the United States that it is necessary to cross the Atlantic to learn how to obtain good street-railway service.

Power Dam Destroyed at Tampa, Fla

The Consumers' dam across the Hillsboro River, at Tampa, Fla., by means of which power was supplied for the Tampa Electric Light and Power company, was completely destroyed last week by the explosion of a dynamite bomb, and the city was left in darkness and also without power for street-car service. The damage is estimated at $24,000.

The disaster is shrouded in mystery. There were watchmen at each end of the dam and a double row of brilliant lights extended from one end to the other. The explosion occurred near the floodgates at the center of the structure, and the person, who put the cartridge in place must have passed one of the watchmen, yet he seems to have completely escaped the vigilance of the guard, and left no trace by which his identity could be established.

It was at first thought that the farmers over whose lands the water was backed by the dam, and who have appealed to the company from time to time, in vain, for damages for losses sustained thereby, had instigated the deed, but there seems to be no proof of this.

The company is operating some of its cars by means of a small emergency steam plant, and from the Morse & Cole shops sufficient power has been secured for 1,000 lights. The company expects to obtain more power from outside sources, and soon temporarily to resume both its lighting and car service.

The dam was built of concrete and, together with the plant, was valued at $350,000.

Northwestern Electrical Association.

The association's transportation committee announces that it has secured favorable rate of fare and one-third for the round trip (on the certificate plan) from points in the northern peninsula of Michigan, Wisconsin, Illinois, Iowa and Minnesota and that the Chicago and Northwestern railway has arranged for special parlor cars to be attached to the 8:30 a. m. train leaving Wells and Kinzie streets, Chicago, January 18th, for Milwaukee.

To enable the committee properly to provide for the comfort of members, it is hoped that all those who expect to attend the Milwaukee meeting will notify it at once, so that ample accommodations may be provided.

All members should purchase regular one-way tickets, taking receipt therefor, which, when signed by the secretary and railway agent at Milwaukee, will entitle them to the one-third fare returning. The committee comprises James Wolff of 320 Dearborn street, W. W. Low of 242 Madison street and George S. Whyte of 19 South Canal street, Chicago.

Peoria Street-railway Franchises.

The Central City Railway company of Peoria, Ill., which announced its intention of applying for an extension of its franchise under the Allen law, has made public the ordinance which it will present to the council.

The term of the franchise is left blank, also the cash compensation to be paid in the form of an annual license. On both of these points the company declares its willingness to negotiate with the council.

In return the company offers to erect a $35,000 convention hall, which Peoria has long been wanting to build, to construct several extensions, to give transfers to and from the Prospect Heights line and extend the present transfer system, to increase the annual licenses and to continue all the provisions of the present ordinances guaranteeing competition by allowing the use of so many blocks of its tracks in the downtown districts for competing companies.

The company offers a bond of $100,000 to guarantee that it will not take advantage of any Allen-law provisions allowing it to charge a straight five-cent fare and bar competition. It will continue the present fare of 12 tickets for 50 cents.

The present franchise has 17 years to run, and it is understood the company wants to get between 30 and 40 years on a compromise.

The fight in Chicago against the 50-year extension asked for by the street railways has had a marked effect on the situation in Peoria. The original Peoria ordinance asked for a 50-year extension, but growing hostility impelled the company to make this a subject of compromise.

CORRESPONDENCE.

New York Notes.

New York, December 6.—The Fifth avenue stage line has been sold, and it may be that its horses and vehicles, long the butt of the wit of the newspaper paragrapher, will be succeeded by smart, up-to-date electric omnibuses. Albert J. Elias, Henry Hart and Edward Lauterbach have bought the property. It is given out that there will be no change in the conduct of the line for the present, but as the gentlemen named are all prominently connected with the Third Avenue Railroad company, it is thought that there may be some connection between that company, which has entered into contract for a 64,000-horse power electric-power plant, and the 'bus line just purchased. It is said to be the purpose of Mr. Lauterbach and his associates, or of the Third Avenue Railroad company, in case it shall be deemed best to turn the Fifth avenue stage line over to that corporation, to substitute at an early day for the horse-drawn stages in Fifth avenue a line of electric vehicles, run by storage batteries charged from the surplus electricity generated at the Third avenue company's power house. Fifth avenue is now asphalted and the automobile vehicles do their best work on smooth pavements. The change from horses as the motive power would do much to promote the cleanliness of the avenue. More than all, no railway tracks can be laid in Fifth avenue, but a line of automobile stages there, with frequent service, rapid movement and up-to-date vehicles, would probably yield large returns and would prove a strong competitor to the Metropolitan's lines in the avenues on either side of Fifth avenue.

The increasing use of acetylene gas has attracted the attention of the fire department, and Fire Commissioner Scannell has taken steps to regulate the trade in calcium carbide in the city. The carbide is stored in most of the sporting-goods houses and bicycle stores in the city. The large dry-goods houses also carry considerable quantities of the substance since the advent of the gas bicycle lamp. In case of a fire in a store containing a quantity of the carbide, the water thrown by the firemen would quickly generate gas and cause a disastrous explosion. Commissioner Scannell has approved regulations framed by the inspector of combustibles, and ordered the fire department to enforce them. According to the new rules, all calcium carbide in transit through the city and in storage must be inclosed in hermetically sealed iron receptacles and marked plainly: "Calcium carbide. Dangerous if not kept dry." No single package must exceed one hundred pounds. As to the sale of the carbide, not more than twenty pounds, either in bulk or in cartridges, can be stored or kept in any building used for dwelling or mercantile purposes, and this amount can be kept only on a permit obtained from the fire department. The permit will provide that all quantities in excess of two pounds shall be in tight metal packages, and kept elevated at least six inches from the floor, in a fireproof safe, above the street grade. The manufacture, transportation, storage, sale or use of liquified acetylene is absolutely prohibited within the city limits. Provision is made for the storage of calcium carbide in sealed receptacles in quantities not exceeding one hundred pounds, in isolated buildings of fireproof construction. The storage must also be with a permit from the fire department, and the entire quantity stored must not exceed five hundred pounds in the aggregate.

M. S.

New England News.

Boston, December 24.—Probably there is no landmark in the whole United States better known than the gilded dome of the Massachusetts State House on Beacon hill. Heretofore this crowning glory of the architectural pile has been luminous only by day, when the rays of the sun shone upon it, but the recent restoration of the old Bulfinch front and other changes in the structure have been made the occasion for an innovation, and the dome is now a blaze of electric lights at night, six encircling rings of lamps being attached to the dome's exterior in such a way as to make it a beautiful, gleaming pinnacle above the surrounding city. Within a few days the large bronze lamps of the grand entrance on the Bowdoin street side of the capitol extension have been completed and are now lighted every evening. There are four of them, each carrying within its great globe six 32 candle power lights.

The latest project for an electric railway in Maine contemplates the connection of Biddeford, Saco and Kennebunk with York Beach.

C. S. G.

Northwestern Notations.

Minneapolis, December 27.—Messrs. Sewer and Meddar of Red Bluff, Mont., have completed the work of several years on the construction of a dam across the Madison River in Madison canon, to develop electric power. Over four tons of dynamite were used, and the side of the mountain was literally blown off into the canon, and the dam constructed at one moment. It is expected to put in huge dynamos and develop electrical power, which shall be transmitted to all the big towns in the state, to furnish power for smelters and other enterprises. It is expected to have the plant in operation in a few months.

The earnings of the Madison (Wis.) electric railway for the year ended December 1st were $45,333.49, an increase of $2,619.07 over the previous year. The Madison Gas and Electric company's earnings for the same period were $56,564.

The suit of William O'Brien at Butte, Mont., against the General Electric Light company for $5,000 damages has been compromised for $1,900. O'Brien's son had a hand burned very badly from a live wire of the company, which was permitted to remain on the ground.

The Kenwood Park (Ia.) Water and Light company is an applicant for a franchise for an electric-light plant.

The George Warren company is installing an electric-light plant at Warren, Wis.

Columbus, Wis., is about to put in an electric-light plant. The city officials are now examining municipal plants in Wisconsin and other states.

The Gugler Electric company of Minneapolis has reorganized as the Gugler Electric Manufacturing company.

The Power and Electric Light company of Britton, S. D., has been incorporated, with $3,500 capital stock.

Work has been begun on an electric-light plant at Canton, S. D. The full capacity of the dynamo has already been contracted for.

Alderman Knauft of St. Paul thinks that electric lighting for streets is cheaper than gas or gasoline, even on the basis of the latest bid made the council, of $115.50 per arc light.

An electric car line is projected from St. Cloud or Sauk Rapids, Minn., to Pierz, Minn., thence to Brainerd. It is understood the Benton Power and Traction company of St. Cloud is behind the plan. This company has just completed arrangements to construct a power dam across the Mississippi River at Sauk Rapids.

The case of Addie M. Shaw for Noah Shaw & Co., against Fitch Gilbert, at Eau Claire, Wis., has been decided in favor of the plaintiff. The suit grew out of the failure of the National Electric Manufacturing company. The plaintiff charges that the National company was given credit for $14,847.64 on the representations of the defendant that the company was wholly solvent. The verdict is practically a judgment for the full amount.

The village of West Salem, Wis., has been having a great deal of trouble over its electric lighting, and there has been a considerable sentiment in favor of putting in a village plant. A contract has now been closed with Dr. E. C. Swarthout of La Crosse for 60 32 candle power incandescent street lamps.

The prospects are pretty good at Oshkosh, Wis., for an interurban line to Neenah. The Citizens' Traction company has about completed securing a right-of-way. J. K. Tillotson has a right-of-way and consent of property-owners, and wanted to sell it to the Citizens' company, but the company regarded his price excessive, and proceeded to get a right-of-way of its own. Then the Fox River Valley Electric Railway company has a right-of-way for the "lake shore" road, between Oshkosh and Neenah.

R. G. Willand of Duluth, Minn., has made a proposition to the council of Thief River Falls, Minn., to establish an electric-light plant. There is also talk of a municipal plant.

Milton, Ia., will vote January 4th on a franchise for electric lighting, to S. E. Irish and others of Keosauqua.

H. E. Johnson of Le Roy, Minn., contemplates putting in an electric-light plant in connection with his flour mill.

It is said that the C., R. I. & P. railroad has offered to bear half the expense of operating the street-lighting plant at Washington, Ia., all night. At present there is midnight service.

All-night service will soon be in force at Decorah, Ia.

The council of Luverne, Minn., has ordered the electric-light plant to run all night for one month, as an experiment.

F. McCormack of Duluth, Minn., is an applicant for an electric-light franchise at Cloquet, Minn.

E. L. Peck, proprietor of the electric-light plant at Zumbrota, Minn., proposes to string wires to Pine Island, Minn., and furnish that village with electric light.

The Dubuque (Ia.) Street Railway company contemplates extending its lines to the high bridge.

The Northern Pacific railway contemplates establishing an electric-light plant, in connection with water-pumping stations at the small towns along its line, and furnishing these communities with electric light and water service. It is proposed to make a canvass among the business men of the towns for light and water service.

E. F. Foote, who has been connected with the electric-light plant at Albert Lea, Minn., for several months, has sold his interests to G. C. Edwards, the owner of the remainder of the stock. Mr. Edwards is now the sole owner. George L. Carrington will be retained as general manager.

Electric lighting is being considered at Plankinton, S. D.

The Postal Telegraph company is expected to reach Spokane, Wash., within a short time.

A broken main shaft in the power house of the Light and Power company at Eau Claire, Wis., caused a stoppage of the street cars in Eau Claire and Chippewa Falls and of the interurban line between them. The latter were tied up for several days.

The Wallace Manufacturing, Electric and Water company of Wallace, Idaho, has added a new dynamo to its plant, thus considerably more than doubling the capacity.

The street-railway company of Des Moines, Ia., has completed the extension of the Scott street line.

The mayor's veto of the proposed ordinance at Winona, Minn., requiring the city engineer to add to his duties those of electrical inspector, was sustained. Another ordinance, avoiding the objectionable features of the first, will be prepared.

There is considerable complaint at Duluth and Superior, that the cars of the two cities do not now run through from one city to the other, instead of requiring the passenger to transfer at the bridge.

The street-railway company of St. Cloud, Minn., has purchased additional equipment in Minneapolis, to bring its stock up to requirements.

The Chippewa Valley Electric Railway company of Eau Claire, Wis., announces that it will put in a large power plant, to furnish power for its lines in Eau Claire and Chippewa Falls and the interurban.

The Citizens' Electric Light company of Lewistown, Mont., expects to have its system ready for operation by April 1st.

The Board of Public Works of Des Moines, Ia., wants an office of electric-light inspector created, to supervise all municipal electric lighting, the placing of lights and inspection of the same.

The city of St. Paul will spend $6,000 the coming year for electric-light poles.

The St. Anthony Falls Water Power company of Minneapolis has awarded the contract to the General Electric company to complete the equipment of the power plant at the lower dam. It includes three waterwheels and electrical equipment, and will increase the power from 7,000 horse power to 10,000. The new contract involves an expenditure of about $100,000.

A bill has been drafted for submission to the Legislature of South Dakota, providing for a reduction of telegraph charges in the state. The maximum charge for 10 words is to be 25 cents.

The October earnings of the Twin City Rapid Transit company in Minneapolis and St. Paul were $186,859, as against $167,670 in 1897. The operating expenses in 1898 were $86,487, and in 1897 $79,893.

The Electric Light company of Tipton, Ia., seeks a renewal of its franchise and says it will put in a steam-heating plant and furnish heat for customers if the renewal is granted.

The county board at West Bend, Wis., decided to purchase apparatus for lighting the county insane asylum.

E. W. Van Orman is arranging to put in an electric-light plant at West Concord, Minn.

The Waterworks company of Merrill, Wis., will put in a dynamo and engine to furnish light for the pump-house and office.

The street-car barn of the Benton Power and Traction company, at St. Cloud, Minn., was burned recently, four cars and a snowplow being destroyed, as well as supplies. The loss was about $15,000, with insurance for half the amount. Arrangements were made at once to operate the system and negotiations were opened in Minneapolis to secure some of the smaller cars that have recently been discarded by the Twin City Rapid Transit company. The destruction of the cars made it impossible to keep the former schedule, but the line was fairly well operated within twelve hours of the fire.

The street railway company of Marquette, Mich., has begun bonding its entire line, to improve the service.

The council of Grafton, N. D., has been petitioned to run the electric-light plant all night.

The General Electric company of Canton, S. D., expects to have its system of incandescent lighting in operation very shortly.

The Fish Bros. Wagon company plant at Racine, Wis., is said to be the first of its kind to be operated by electric power. There is a motor for each machine, which does away with great quantities of heavy shafting, pulleys, belting, etc., and reduces the danger to workmen materially.

The receivers of the Fox River Electric Railway company of Green Bay, Wis., have been enjoined from expending any more funds in improvements, and the stockholders ask that the business be wound up and the plant sold at auction without further delay.

It is said the project of an electric line between Stevens Point, Wis., and Oshkosh, will be given aid by the towns through which it will pass. Oshkosh will be sounded soon on the matter of aid.

The matter of an electric-light plant for Menahga, Minn., is being agitated.

The General Electric company has passed a deed conveying title to the Des Moines Edison Light company of Des Moines, Ia., for the Center street water-power electric-light plant. The General Electric company is putting in improvements which will add nearly 30,0000 incandescent lights. It is understood that a reduction of rates will be made.

The Consumers' Electric company and the Union Electric company were awarded the contracts for furnishing electric street lighting for Seattle, Wash.

The street railway at Oskaloosa, Ia., was sold for taxes to C. S. Longshore, for $837.36.

The council of Hibbing, Minn., is considering the formation of a board of water and light commissioners, to have control of the electric-light and water plants.

Tomahawk, Wis., will install an electric fire-alarm system.

The Citizens' Traction company of Oshkosh, Wis., is understood to be negotiating for the purchase of the line between Neenah and Appleton, and proposes to consolidate it with the Citizens' company's system.

The council of Madrid, Ia., is considering an application for an electric-light franchise. M. S. P.

PERSONAL.

On Wednesday afternoon, December 21st, in Plymouth Church, Milwaukee, Mr. James Gilbert Hickcox was united in marriage to Miss Clara Louise Whitcomb of Milwaukee. As is well known throughout the west, Mr. Hickcox is now the secretary and treasurer of the Cutler-Hammer Manufacturing company, Chicago. Mr. Hickcox was manager of the American Rheostat company up to the time of the consolidation with the Cutler-Hammer company. Mr. Hickcox has already made a name for himself in the electrical field and there will be many friends to unite in wishing him all happiness in this his latest venture. Mr. and Mrs. Hickcox will be at home after February 1st at 163 Oak avenue, Evanston.

On the morning of the day before Christmas the store of the Commercial Electrical Supply company of St. Louis was the scene of an interesting event. For some time the employes of the company had been desirous of giving President Joseph Franklin, Jr., some token of their appreciation of his many little kindnesses and his thoughtfulness as their employer. A committee had been selected to choose a gift, and on Saturday morning, on Mr. Franklin's arrival at the store, Manager of Sales Paul D. Cable, in a few suitable words, presented the surprised president a beautiful piece of furniture in the form of a cabinet for his home. Mr. Franklin responded appropriately after the first surprise had worn off and thanked the donors for their faithful service, as well as their personal consideration.

ELECTRIC LIGHTING.

The Commissioners of Parks and Boulevards of Detroit have under consideration a plan to erect a new $10,000 sub-station electric-lighting plant, on Belle Isle, to supply current for the new lights on the island.

On October 7th M. D. Munger, former president of the Canandaigua Electric Light and Railroad company, presented an application to the Board of Trustees of Canandaigua asking for an electric-lighting franchise. The trustees held several meetings to consider the question, at which taxpayers and other interested persons discussed the subject. After careful consideration, the trustees refused to grant the desired franchise on the grounds that the present company was giving good service, and that it was not for the best interests of Canandaigua to encourage a new company, which would result only in impairing the present corporation's usefulness without helping the taxpayers.

ELECTRIC RAILWAYS.

G. W. Bullis of Ann Arbor and Frank Bullis of Johnstown visited Hastings, Mich., recently in the interest of an electric road to be run from Battle Creek to Hastings. They secured the right-of-way from Battle Creek to the limits of Hastings and had a consultation with some of the members of the council at the city hall and informally talked the matter over. They asked for a three-year franchise.

TELEGRAPH.

A press dispatch, dated San Juan de Porto Rico, December 13th, announces that General Guy V. Henry, in command of the department of Porto Rico, has instructed the post commanders to prevent the landing of the French cable on Porto Rican soil.

The announcement is made that "the Dakota Central Telephone company of Aberdeen, S. D., has received word that the government has adopted its lines as a part of the postal system of the United States in peace and war." The company may possibly have secured some privilege under the telegraph law and has probably magnified the importance of the transaction.

The Grand Trunk and its telegraph operators have not yet reached an agreement. The company has sent a circular to all the telegraphers in its service, asking each one if he belongs to the order, and if he has authorized the committee to act for him. Mr. Powell says the members of the order in the

employment of the company have been instructed to refuse to answer the questions, and if any of them are discharged for refusing to answer it will only tend to precipitate a strike.

It is announced that early next spring the Postal Telegraph-cable company will commence extensive improvements and extensions of its service throughout Iowa that will involve the expenditure of a large amount of money. Recently the company incorporated in Iowa, with headquarters in Des Moines, and the improvements will be made in the name of the Iowa corporation. First of all, the company will establish a general office in Des Moines, from which its Iowa business will be managed and directed. Then trunk lines will be built across the state, radiating from that city. The present plan is to add to and improve the line extending from Chicago through Dubuque, Waterloo, Marshalltown, Des Moines and St. Joe to Kansas City, and to equip it with through wires from each of the points named to Chicago and with local wires for the transmission of business between the several points. Another trunk line will be built from Sioux City southwest through Carroll and some of the more important towns to Des Moines, and thence to Oskaloosa, Ottumwa, Fort Madison and Keokuk, and down the river to St. Louis. From these two trunk lines branches will be built or connections made with lines already in use, by which practically all the cities and towns in the state will be reached.

POWER TRANSMISSION.

The plant of the Blue Lakes Water company will be enlarged and current supplied to Stockton, Cal. The company has found a market for the entire product of its present plant, and under the direction of the Standard Electric company it is to supply not only Stockton and the surrounding towns with light and power, but it is also expected to extend the power line to Oakland and possibly across the bay to San Francisco. The building of the power line out of Stockton was commenced under the direction of Engineer E. D. Lehe. Aluminum wire will be used.

The Herald of the City of Mexico says that "all over this country water powers, within reasonable distance of centers of population, are being sought for, and, although the best informed people do not believe there are many of them, still there are enough to prove of great utility in prompting manufacturing enterprises in this land of dear fuel. As is well known, President Diaz has given much consideration to this matter, and he has, in several instances, greatly aided enterprising people who had discovered powers and were in peril of being deprived of the results of their labors by unprincipled persons who stood ready to levy tribute on their undertakings. It is to the credit of the president that he does not allow the blackmailing of men of enterprise and energy. The transmission of power by wire over long distances is receiving, in this country, the enlightened encouragement of the government."

PUBLICATIONS.

Under the title "Transformer Design and Operation," the General Electric company has issued, in pamphlet form, two important papers on the subject of electrical transformers. One presents the views of the central-station manager by Mr. W. F. White, general manager of the Omaha (Neb.) Electric Light, Heat and Power company; the other, by Professor Winder Elwell Goldsborough, deals intimately with the question of transformer economy. The first paper, which was read before the American Institute of Electrical Engineers, is the record of long personal experience with the operation of transformers, under actual commercial conditions, showing the relation of the many losses, incident to the use of many small transformers, to the earning capacity of the plant and the very tangible economies realized as the result of the substitution of a few high-efficiency transformers of large capacity. Mr. White gives examples of these economies, reduced to dollars and cents. In his station a saving of $6,000 per annum in the cost of coal alone was realized as the result of the practical application of lessons drawn from his extended observation and experience. Professor Goldsborough's paper was read before the National Electric Light association, and treats of the inherent economy of transformers of several designs and forms of construction. It contains many able arguments in favor of the use of high-grade transformers, and emphasizes the necessity of frequent tests as the only means of detecting leaks, losses and the general depreciation of transformers. Professor Goldsborough gives examples of manufacturers' claims belied by careful test, but instances other cases in which guarantees have been exceeded, and urges upon station managers the wisdom of keeping as vigilant a watch on the efficiency of their transforming apparatus as upon the items of operating expense and maintenance, if economical results are to be obtained. To these papers the General Electric company has added several maps, showing graphically, the significance of the substitution of a few large transformers for numerous small ones. The pamphlet is, as usual, well printed and illustrated, and should find a prominent place in the literature of every alternating-current station and every educational institution. It will be sent free by the General Electric company.

TRADE NEWS.

A. H. Frazer of Kahoka, Mo., former owner of the Kahoka electric-light plant, is in the market for a 300-light, 110-volt direct-current machine, with engine and boiler complete.

"Compliments of the Season," coming from the Joseph Dixon Crucible company of Jersey City, means a package of pencils, suitable for the work of the recipient. The Dixon brand is as welcome as a back subscription in a country newspaper office, and the thoughtfulness of the company in remembering its friends is fully appreciated.

Joseph P. Cullen of Buffalo has secured the contract for ornamental street-lamp posts in Syracuse. They will be similar to the posts now used by the Buffalo General Electric company, but the lamps will be seven feet apart instead of six, as in the case of the Buffalo lamps. They will be fitted with a special locking device, suggested by W. H. Giroin, manager of the Electric Light and Power company of Syracuse.

The Roland F. Oakes company of Rutland, Mass., has purchased two 40-horse power engines for electrical purposes from the Ball Engine company of Erie, Pa. The Hotel Hamilton, Island of Bermuda, has just placed in operation a direct-connected lighting plant, consisting of a Westinghouse generator and a Ball engine. The city of Veedersburg, Ind., is erecting an electric plant for which the Ball Engine company will furnish the engine.

The Lombard Water Wheel Governor company reports that the demand for its governors is constantly on the increase. During last month it received orders for upward of 20 governors to regulate 41 water wheels, which will develop 15,750 horse power. More than half of this machinery will be used in electric stations, principally in power transmission plants and electric-railway stations, the balance being in textile and other manufacturing plants driven by water power.

Mr. Ferdinand Schwedtmann, general superintendent of the Wagner Electric Manufacturing company, has just returned from a European trip. In view of the plans of the company for the extension of its business, it was deemed advisable that a general survey of European methods of manufacture should be made, and it was for this purpose that Mr. Schwedtmann visited the leading centers of Europe. The Wagner company is now executing some very important contracts, which, it is believed, will attract considerable attention, both in this country and abroad. As the engineering and manufacturing departments are under the personal direction of Mr. Schwedtmann, his trip will doubtless have material results.

Constant demand for a bell that could be used in exposed places, such as mines, railroad depots, factories, etc., has led Mr. Lungen of Edwards & Co. to invent the weather-proof bell, put on the market by that concern. The motion of its hammer is direct and is unlike any other; it does not work on a pivot; it is made single stroke or vibrating; its vibrations are so rapid that when used to give signals they will be more positive than when given by single strokes. The case has no crevices to admit dampness or dust. The hammer strikes a very powerful blow and its vibrations are adjusted from the outside of the case by a screw. The binding posts and interior wires are insulated from the case to prevent leakage of current. The bell is made for single stroke, vibrating, or both. It will work in any position and is made to operate on any voltage.

The general trade throughout the west and southwest is reported by the Western Electrical Supply company of St. Louis as having been unprecedented for this season of the year. The company reports excellent sales for the Moloney transformer, for which it is general western agent. It claims that the lighting companies that are using the Moloney transformer, after subjecting it to the most severe tests, have reported most gratifying results. The company also reports an increasing demand for the Monarch lamp, which it claims is giving universal satisfaction throughout the west generally. The loricated iron-armored conduit, which is handled extensively throughout the west by the Western Electrical Supply company of St. Louis, is reported to be steadily advancing in favor, the business in this line having increased to a very satisfactory basis. The company carries a very large and well-assorted stock of this conduit in St. Louis, and is making prompt shipments of all orders.

The Pelton Engineering company has been incorporated at Cleveland, Ohio, by W. H. Pelton, H. H. Holding and Allan Bassett, and has acquired all the available assets of the Cleveland Electric Trading company and of the Cornman company, assigned. It is the purpose of the new corporation to act as contracting engineer in the erection of steam and electric plants and as manufacturers' agent. It has already some very good agencies and has considerable work on hand. It will carry a line of station supplies, making a specialty of repairs and supplies for Brush arc apparatus. The company expects to locate very shortly at 1076 Hamilton street, in the buildings now occupied by the Parish & Bingham company, and will be exceptionally well located for the handling of general electrical business. Regarding the personnel of the firm, it may be said that Mr. Pelton has had active experience handling electrical machinery and in the design and erection of power-station work. Mr. Holding, the vice-president of the company, graduated from Rose Polytechnic Institute in 1887 and entered the engineering department of the Thomson-Houston Electric company, remaining with that company until the consolidation with the Edison interests. He then entered the engineering department of the General Electric company, remaining there for several years as expert, during which time he installed several very large plants. Mr. Bassett, secretary of the company, who will take the sales department, has already an exceptionally wide acquaintance among central-station men and the electrical trades. He is thoroughly familiar with the principal systems of light and power distribution and has also had considerable experience pioneering electrical enterprises. Manufacturers who are not now represented in the central section may do well in corresponding with this company, as it will be well located and will undoubtedly make itself felt in electrical circles.

BUSINESS.

The Michigan Electric company of Detroit is now installed at its old stand. Since the fire the building has been completely renovated and the supplies on hand are complete.

A representative of the Western Electrician when at Sandusky, Ohio, asked, "Is the Partridge Carbon company busy?" and was answered: "Yes, very busy." This representative visited the works recently and found that this company is operating to its full capacity, and with orders booked for at least two or three months ahead. This is an assurance that the goods manufactured by this company are retaining all their popularity.

The Central Electric company is in receipt of a great many flattering comments from the trade on its new general catalogue, of which the following is a sample: "We beg to acknowledge the receipt of a copy of your new general catalogue, and thank you for the same. It is a very complete and fine production in every respect. Kindly send discount sheet." As the catalogue contains a quantity of valuable data, outside of the merchandise illustrated, it is well worthy of careful examination and preservation.

It is credibly announced that the business of the Gordon Battery company is rapidly increasing, and friends of the company will be pleased to hear that it will declare immediately a semi-annual dividend of four per cent. on the preferred stock from the net earnings of the last six months of the year. The Gordon cells are fast being introduced into the telephone field and the fire-alarm service of the country. A majority of the railroads have adopted the Gordon cell for operation of signals, and thousands are daily in use.

The John Kammer company, Chicago, reports having produced (to fill a number of Christmas-tree orders this season) a miniature two-candle power incandescent lamp, coil-filament, and used two in series on 110-volt circuits, and states that this is the first instance of such a lamp having been successfully operated. It also claims that on a tree burning 100 lamps there was taken but twenty amperes, and that by reason of this lamp burning two in series, instead of eight, as has been the case heretofore, a great deal of trouble and expense in wiring is saved.

The Western Electric company of Chicago will send, upon application, copy of Bulletin No. 100, describing fusible cut-outs for transformers, lines and switchboards. These cut-outs are of the S. K. C. types and are of the most modern design and construction. They are adapted for any voltage between 1,200 and 6,000 volts. The cut-outs of the switchboards are of the multiple type, and if one fuse blows out another can be immediately switched into the circuit. The fuses for transformers and lines are mounted on weather-proof boxes, and all details have been carefully worked out.

Duncan Bond, the Denver agent for the Ball Engine company of Erie, Pa., has closed a contract with the Mountain Electric company in Denver, covering the engines for electrical plant of the new Arapahoe County Poor Farm buildings. The Mountain Electric company, acting as district manager for the Westinghouse Electric and Manufacturing company, contracted with the county commissioners to furnish the necessary electrical and steam equipment. The units will be direct-connected and of the latest types of the respective makers.

It is said that when a postoffice clerk in Scotland wants a new pencil, he has to fill out four forms, make an affidavit before a justice of peace and send the documents to the postmaster-general. The documents have to be accompanied by the stump of the old pencil and a separate statement and affidavit as to when the last pencil was furnished. This seems like a great deal of trouble over a small affair, but it all depends on circumstances. For instance, after using American graphite pencils, one would be willing to go to much more trouble than the government clerk in Scotland rather than substitute an inferior article.

The Wagner Electric Manufacturing company, through its manager of sales, Mr. E. H. Abadie, has secured the largest transformer order ever placed in this country. The magnitude of the order itself is not the only surprising condition, but further than this the horse power capacity of the units is 800 horse power larger than any other transformers installed in this country to date. The contract was placed by the Union Carbide company for its carbide works at Niagara Falls, N. Y., for seven static transformers of 2,000 horse power output each, and two static transformers of 500 horse power output each, complete with switchboards for operating them. The transformers are to be of the oil-filled type with water coils for lowering the temperature of the oil. The contract was closed on definite specifications as to iron and copper losses, full three-quarters, one-half, one-quarter and one-tenth load efficiency, guaranteed as to temperature rise, also as to insulation testing, and guarantees made as to 50 per cent. overload in current. This equipment complete was purchased from the Wagner Electric Manufacturing company of St. Louis. As the electrical apparatus installed by the Union Carbide company is subject to the approval of the Niagara Falls Power company, and as Mr. Stilwell, the managing director, has given his approval of the specifications agreed upon, it will be seen that the Wagner company is recognized by all as capable of undertaking and successfully completing any installation that seems feasible in the minds of the engineers. By securing this order, the Wagner company has established a record as builders of the largest power transmission transformers in the world, which, combined with their 40,000-volt high-tension transformers, which are now operating at Provo, Utah, and Telluride, Colo., places them in the van as leading the world in the building of the largest single-unit transformer and for the highest voltage. The Wagner company is also getting some very large orders in high potential transmission transformers, where the units range from 100 to 500 horse power, and the high-tension voltage as high as 40,000 volts.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 20, 1898.

616,079. Electrical Burglar-alarm. Clyde Coleman, Chicago, Ill. Application filed June 29, 1896.

A closed controlling circuit is employed, including a resistance coil and a meter electrically connected therewith, a plurality of interrupted circuits being connected with the controlling circuit upon opposite sides of the resistance coil, the circuits being insulated from each other and braided together.

616,082. Thermostatic Auxiliary Fire-alarm System. Albert H. Cross, New York, N. Y. Application filed June 1, 1898.

One feature is a normally closed auxiliary circuit including a section of fusible wire extending throughout a building, a compound or thermostatic wire arranged parallel to the fusible wire and normally disconnected from the auxiliary circuit, and a main battery connected to the thermostatic or compound wire.

616,110. Electric Switch. William J. Kelly, Boston, Mass. Application filed May 1, 1897.

A rotatable shaft, a plurality of commutators loosely mounted thereon, operating handles for the commutators, clutch mechanisms to couple the operating handles with the commutators, and locking devices for the handles to render the same fast to the shaft.

616,111. Arc-light Regulator. William J. Kelly, Boston, Mass. Application filed January 29, 1896. Renewed June 1, 1898.

A variable resistance composed of a series of resistances, increasing and diminishing irregularly, is described, to enable the arc lamp to be regulated without interfering with its functions, and a circuit controller coöperates with the variable resistances.

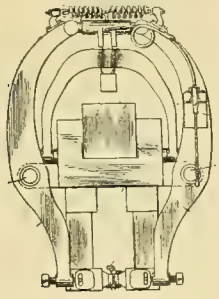
616,120. Railway Switch. Edwin S. Leaycraft, Jersey City, N. J. Application filed February 3, 1898.

The device consists of a switch tongue, an armature operated by a magnetic device carried on a vehicle moving along the railroad track, an arm carrying the armature and oscillating transversely of the railroad track, and a mechanical connection between the switch tongue and armature whereby movements of the latter will be transmitted to the former.

616,136. Auxiliary Fire-alarm Telegraph Apparatus. Bartholomew Oehmen, New York, N. Y. Application filed January 14, 1898.

The street or patrol box has a switch by which the box is normally cut out of the line, a double magnet is located adjacent to the box, an armature coöperates with two poles of magnet for actuating the switch and an armature coöperates with the other poles of the magnets for tripping the box.

616,139. Method of Electrolytically Treating Straw or Other Fibrous Material. Goldsbury H. Pond, Ashburnham, Mass. Application filed July 9, 1897.



NO. 616,345.

The method described of treating straw and other fibrous material consists in electrolytically decomposing a solution of chloride of sodium in the presence of calcium hydrate in a suitable tank, the resultant being a solution of hypochlorite of sodium, hypochlorite of calcium and chloride of sodium, and uncombined calcium hydrate, then allowing the calcium hydrate to settle and drawing off the solution, heating it and subjecting the straw to its action, then returning the solution to the decomposing tank containing the uncombined calcium hydrate, and reinforcing it with fresh chloride of sodium and repeating the operation.

616,148. Magnetic Switch. Charles E. Scribner, Chicago, Ill. Application filed April 23, 1897.

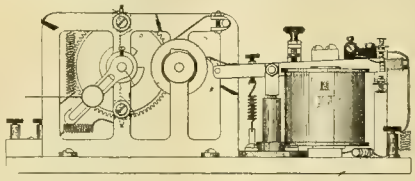
The base has a socket for a plug formed in it, with a movable armature and switch contacts controlled thereby near the socket, a plug and a mass of magnetic material associated therewith, the mass of magnetic material or armature being magnetized, whereby the armature is moved when the plug is in its socket.

616,165. Carbon for Electric Welding. George W. de Tunzelmann, London, England. Application filed February 25, 1898.

An electrode for electric welding, brazing and the like purposes is composed of carbon and metallic oxides combined together by admixture.

616,174. Electric Voting Machine. Frank S. Wood. Boston, Mass. Application filed January 16, 1897.

An electric voting machine is provided with a framework or casing having names arranged in party groups as candidate indicators, corresponding circuit closers contiguous thereto as a means for voting, and a hinged door for each group adapted to make visible or invisible the inclosed registering dials; first electric circuits connecting the circuit closers with cooperating switching devices, adapted to transmit voting impulses; correlative second electric circuits, connecting two independent circuit closers with each other and with cooperating devices adapted to receive and register voting impulses; registering and computing devices for all candidates, adapted to be electrically operated but once by a single voter and for only one candidate for a single office, and then only by the simultaneous cooperation of all the circuit closers correlative therewith; a vertically movable horizontal section adapted to be operated as a circuit controller by means of the weight of the voter resting upon it while voting; and a telltale device adapted to be operated by means of an elastic reaction upon the removal of the weight of the voter from the horizontal section.



NO. 616,358.

616,186. Microphone Containing Granular Carbon for Retaining Material in Position. Lars M. Ericsson, Stockholm, Sweden. Application filed April 6, 1898.

Claim is made for a disk, a ring of elastic material surrounding the same and projecting beyond the face thereof, a diaphragm opposite the disk, carbon granules in the space bounded by the elastic ring, the disk and the diaphragm, and the spring for pressing the elastic ring toward the diaphragm.

616,190. Electric Operation of Elevators by Three-button Push Systems. John D. Ihlder, Yonkers, N. Y. Application filed December 16, 1897.

There is the combination with the motor and a reversing switch controlling the motor, of a circuit connected to the switch and containing two sets of push buttons, a branch of the circuit leading from each set of push buttons, a circuit maintaining magnet in each branch, a parallel circuit to each branch of the circuit including a non-interfering magnet, and contacts of each branch controlled by the non-interfering magnet of the other branch.

616,222. Telegraph Repeater. Frederick W. Cole, Newton, Mass. Application filed August 5, 1893.

This instrument comprises a series of circuit controllers, a repeating train for operating them, a locking lever for the train, a series of operating levers arranged adjacent to the locking lever, a series of electro-magnets and armatures therefor, and connecting rods connecting the armatures with the operating levers.

616,265. Field Magnet for Electric Machines. Sidney H. Short, Cleveland, Ohio. Application filed July 28, 1898.

A field magnet for electric machines has grooves formed in the pole surface, in combination with a grid arranged to be received in the grooves.

616,339. Ammeter for Alternating Electric Currents. Waldo A. Layman, St. Louis, Mo. Application filed April 4, 1898.

This instrument consists of a suitable fixed element, a suitable movable element, a primary circuit for one of the elements, a secondary circuit for the other of the elements, and a suitable transformer, the primary coil of which is in the primary circuit for supplying current to the secondary circuit.

616,343. Electric Generator for Cycles or Other Vehicles. James Moores and Henry O. Farrell, Manchester, England. Application filed May 24, 1898.

An electric generator for a cycle or other vehicle has a driving-pulley and bearings approximately parallel to the plane of the vehicle wheel and means whereby the generator is yieldingly pressed against the wheel.

616,358. Electrically-operated Regulator for Dampers, etc. George F. Richardson, Hartford, Conn. Application filed April 15, 1898.

The arrangement comprises an electromagnet, a vibratory armature, a pawl at one end, a circuit maker and breaker consisting of a lever pivoted at right angles to the other end of the armature, a contact on the lever, a second contact carried by but insulated from the armature and stops for rocking the lever, a ratchet wheel engaged by the pawl, a disk in the same circuit with the magnet and having an interval removed from its periphery, the disk being rotated from the ratchet wheel, two terminals contacting with the disk except when its interval interposes, branch circuits leading from these terminals to independent points, a thermostat included in the main circuit, with its free end adapted to make contact with either of the points, and mechanical connections between the disk and a damper or the like for operating the latter.

616,396. Combined Bearing and Power-transmitting Device. Carl O. C. Billberg, Lewisburg, and Paul A. N. Winand, Philadelphia, Pa. Application filed November 23, 1897.

Power transmitting mechanism is described in which are combined an electric motor or dynamo containing a central rotating element, a surrounding element, a shaft for the central rotating element having a pinion at each end, pulleys at the ends of the surrounding element, each pulley being concentric with and surrounding one of the pinions of the shaft, and wheels intermediate of each pulley and its pinion, the wheels constituting the only bearings for both pulley and pinion and serving to transmit power from one to the other.

616,403. System of Electric Traction. Michelangelo Cattori, Rome, Italy. Application filed December 24, 1897.

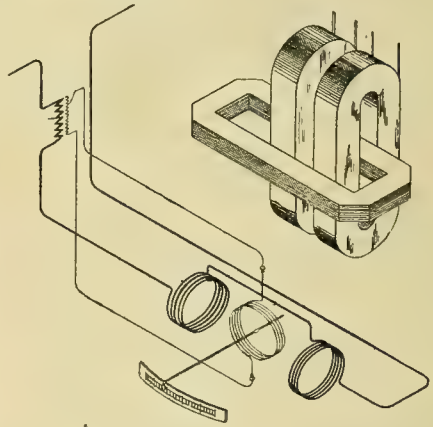
An electric railway is provided with two substantially parallel sectional conductors, arranged in two circuits, an independent generator included in each circuit, terminal switches whereby one pole of each generator may be connected with the corresponding terminal of either conductor of the same circuit, and junction switches whereby the other pole of each generator may be connected with the other end of either conductor of the same circuit.

616,417. Indicator. Frederick Hackmann, Milwaukee, Wis. Application filed November 26, 1897.

A lever is adapted to be turned from its normal position on each completion of the circuit, and cause the printing wheel to descend and make an imprint on the strip of material passing, and mechanism adapted during a cessation of the electrical makes and breaks, to cause the printing wheel to return to its normal position to print the initial number or character on the strip of material to be printed upon.

616,435. Electrically-welded Joint. Richard Eyre and William Dishong, Johnstown, Pa. Application filed February 7, 1898.

A rail joint is described comprising the combination of the rails and splice bars welded to and connecting the same, one of the welds which connect the rails and splice bars being a union between the central portion of the splice bars and the abutting ends of both rails, the others of the welds being between each end of the splice bars and one of the rails.



NO. 616,339.

616,436. Electric Welding. Henry F. A. Kleinschmidt, Johnstown, Pa. Application filed February 7, 1898.

The method of electrically welding bars to the sides of rails consists in passing the heating current transversely through the bars and rail, forming the weld by laterally compressing the bars against the rail, and retaining the bars continuously under compression and in contact with cold conducting surfaces until they have cooled sufficiently to have lost substantially all appearance of glow.

616,437. Electric Welding. Henry F. A. Kleinschmidt, Johnstown, Pa. Application filed February 7, 1898.

The method described of joining rails and parallel splice bars consists in welding the central portion of the splice bars to the sides of both rails, and then welding opposite end portions of the splice bars to the sides of each rail.

Western Electrician.

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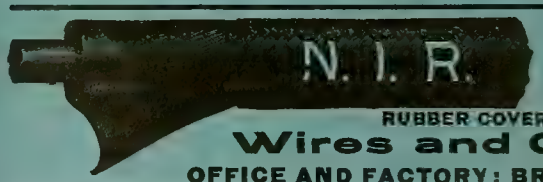

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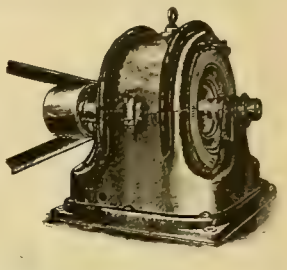

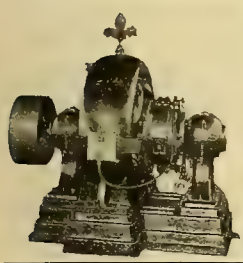

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FOR PERFECT INSULATION.

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We having received a very large shipment of

CORED CARBONS

Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

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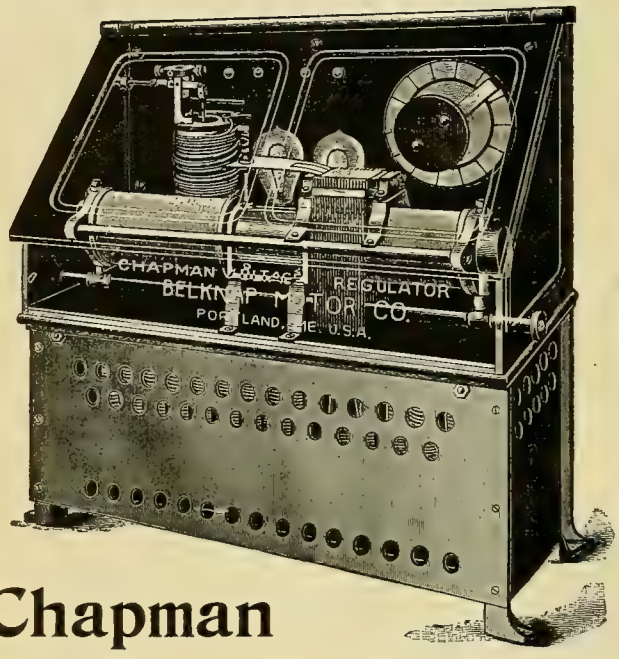

Chapman Voltage Regulators

insure **Steady Light** from unsteady power.
For use with Steam or Water Plants.
—**No Attendance Required.**—
Regulator sent on 30 days' trial.
Let us show what it can do for you.

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We are agents for the

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This meter is calibrated ready for instant use.
This meter requires no knowledge of electricity to erect.
This meter shows the load passing every instant.
This meter is hermetically sealed.
This meter measures correctly with uneven loads.
This meter can be calibrated with a watch in six minutes.
This meter requires no lubrication.
This meter is magnetically shielded.
This meter is direct reading, having no multiplier.
This meter does not require one-thousandth of a horse power.
This meter will operate for years without opening.
This meter has no springs, jewels or frictional errors.
This meter once right is always right.

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For Enclosed Arcs.

As COLUMBIA is the gem of the ocean, so is the "COLUMBIA" the gem of Enclosed Arc Carbons.

MANUFACTURED BY

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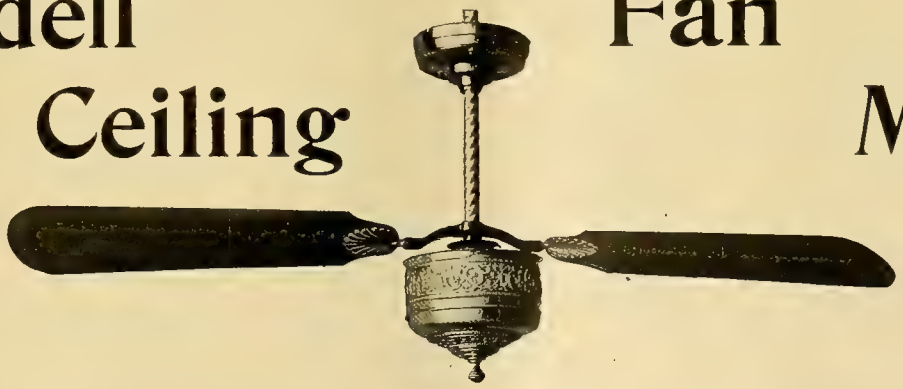

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For 110 to 120 Volt Direct Current Circuits.

IN ELEGANCE OF DESIGN AND ECONOMY OF OPERATION IT IS UNEQUALLED.

GET OUR LATEST PRICES.

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Manager.

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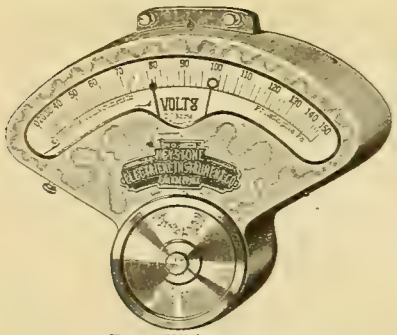

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Switchboard Voltmeters, Ammeters, Ground Detectors and Differential Voltmeters.

We meet all the requirements of modern Central Stations or Isolated Plants, whether using direct or alternating current circuits.

Our instruments are constant and durable, sensitive and accurate, pleasing in appearance and always correct.

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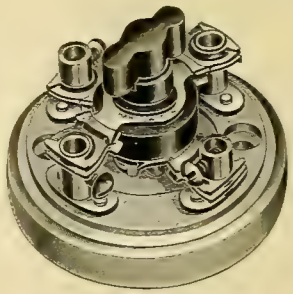
Caused by defective switches can be secured by making sure that the words **"HART SWITCH"** are stamped in the metal.



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HART 20 AMPERE DOUBLE POLE

In connection with next lot of arc lamps you install.

Our Illustrated Catalogue will be mailed on application.

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Electric Ry. Equipment Co.
Farr Tel. & Cons. Sup. Co.
Michigan Pipe Co.

Cut-Outs and Switches.
Automatic Switch Co.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
General Elec. Co.
Hart & Hegeman Mfg. Co.
Hill, W. S. Electric Co.
Illinois Electric Co.
K. & W. Company.
Leonard, H. Ward Elec. Co.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Dynamos.
Akron Elec. Mfg. Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Northern Electl. Mfg. Co.
Sargent & Lundy.
Sprague Electric Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warner Co., Wm. F.
Warren Elec. Mfg. Co.
Warren-Medbery Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Economizers, Fuel.
Broomell, Schmidt & Co.
Fuel Economizer Co.

Elec. Heat'g Appliances.
American Elec. Heater Co.

Electric Meters.
American El. Meter Co.
Zamel Arc Light Meter Co.

Electric Railways.
General Electric Co.
Sprague Electric Co.
Walker Company.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Bain, Foree.
Broughton, H. P.
Lemon, L. E.
McRae, A. L.
Miller, K. B.
Sargent & Lundy.
Wray Co., John C. Co.

Electrical Instruments.
Belknap Motor Co.
Central Electric Co.
Commercial El. Supply Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
General Electric Co.
Hill, W. S. Electric Co.
Illinois Electric Co.
Keystone El. Instrument Co.
Leonard, Ward, Elec. Co.
Paiste Co., H. T.
Queen & Co.
Western Electric Co.
Weston Electrical Inst. Co.

Electrical Specialties.
Akron Ins. & Marble Co.
Central Electric Co.
Commercial El. Supply Co.
Ohio Elec Specialty Mfg. Co.
Pacific Electric Co.

Electro-Magnets.
Varley Duplex-Magnet Co.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
General Electric Co.
Hobart Elec. Mfg. Co.

Engines, Gas.
Otto Gas Engine Wks.
Wray Co., John C. Co.

Engines, Steam.
Ames Iron Works.
Armington & Sims Co.
Ball Engine Co.
Bullock M. C. Mfg Co.
Skinner Engine Co.
Westinghouse, Church, Kerr & Co.
Wray Co., John C. Co.

Fan Outfits.
Carlisle & Finch Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Edison Mfg. Co.
Emerson El. Mfg. Co.
General Electric Co.
Illinois Electric Co.
St. Louis El. Supply Co.
Schneider Mfg. Co.
Specialty Mfg. Co.
Sprague Electric Co.
Wagner Electric Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Delaware Hard Fibre Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Files.
Barnett Co., G. & H.

Fixtures, El. & Comb'n.
Central Electric Co.
Commercial El. Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuse Wire.
Central Electric Co.
Chi. Fuse Wire & Mfg. Co.
Commercial El. Supply Co.
Electric Appliance Co.

Gaskets.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

Gas Lighting, Electric.
Central Electric Co.
Partrick, Carter & Wilkins.
Western Electric Co.

Gears.
Besly & Co., Chas. H.
Link-Belt Machinery Co.

General Elec. Supplies.
Ansonia Electrical Co
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.
Hill, W. S. Electric Co.
Illinois Electric Co.
Partrick, Carter & Wilkins
Peru Elec. Mfg. Co.
St. Louis El. Supply Co.
Western Electric Co.

Globes and Electrical Glassware.
Central Electric Co.
Commercial El. Supply Co.

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Insulators and Insulating Materials.
Akron Ins. & Marble Co.
Ansonia Electrical Co.
Atlantic Alcatraz Asph. Co.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Delaware Hard Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co.
Illinois Electric Co.
Kartavert Mfg. Co.
Mass. Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Western Electric Co.

Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Montauk Multiph. Cable Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.

Junction Boxes.
Bossert Elec. Const. Co.
Leonard, H. Ward Elec. Co.

Lamps, Incandescent.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.,
Illinois Electric Co.
Lynn Incandescent Lp. Co.
Sawyer-Man Elec. Co.
United Elec. Imp. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Link-Belt Machinery Co.
Stilwell-Bierce Smith-Valle.
Westinghouse, Church, Kerr & Co.

Mica.
Central Electric Co.
Commercial El. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
Schoonmaker, A. O.

Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.

Motors.
Akron Elec. Mfg. Co.
American Engine Co.
Belknap Motor Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Illinois Electric Co.
Northern Electl. Mfg. Co.
Sargent & Lundy.
Sprague Electric Co.
Stanley Elec. Mfg. Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wray Co., John C.

Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

Paints.
Atlantic Alcatraz Asph. Co.
Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Standard Paint Co.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

Platinum.
Baker & Co.

Poles.
Berthold & Jennings.
Central Mfg. Co.
Electric Ry. Equipment Co.
Lindsley Bros.
Michigan Pine Company.
Perrizo & Sons.
Pittsb. & L. Sup. Iron Co.
Torrey Cedar Co.
Valentine-Clark Co.

Porcelain.
Akron Ins. & Marble Co.
Central Electric Co.
Commercial El. Supply Co.
Empire China Works.
Peru Elec. Mfg. Co.

Refiners.
Swarts Metal Refining Co.

Re-Winding—Repairs.
Chicago Armature Co.
Chicago Edison Co.
Hodge, Walsh & Loring.
Morrell Electric Works.

Rheostats.
Automatic Switch Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Leonard, Ward, Electric Co.
Ohio Elec. Specialty Mfg. Co.
Westinghouse El. & Mfg. Co.

Roofing.
Cincinnati Corrugating Co.

Second-Hand Machin'y.
Cornman Co.
Hine & Co., L. A.
Hodge, Walsh & Loring.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Illinois Electric Co.
Partrick, Carter & Wilkins.
Western Electric Co

Speed Indicators.
Besly & Co., Chas. H.
Keystone El. Instrument Co.
Queen & Co.
Weston Electrical Inst. Co.

Steel Boxes.
Bossert Elec. Const. Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Lockie & Viall.

Street Cars.
Stephenson Co., John.

Tapes, Insulating.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Andrae & Sons Co., Julius.
Bissel & Co, F.
Boardman-Tucker Co.
Cabinet Mfg. Co.
Coit, H. A.
Commercial El. Supply Co
Ericsson Telephone Co.
Farr Tel. & Cons. Sup. Co.
Holtzer-Cabot Electric Co.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A., Tel. & El. Mfg. Co
Mason Tel. Pay Station Co.
McEvoy, C. H.
Northwest Engineering Co
Penn. Electric Co.
Rawson Electric Co.
St. Louis El. Supply Co.
Standard Tel. & El. Co.
Sterling Electric Co
Stromberg-Carlson Tl. M. Co.
Tobie, W. S.
Viaduct Mfg. Co.
Western Electric Co.
Western Tel. Cons. Co.
Wilhelm Tel. Mfg. Co.

Tools.
Klein & Son, Mathias.

Transformers.
Central Electric Co.
Commercial El. Supply Co.
Diamond Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Westinghouse El. & Mfg. Co

Trolley Cord.
Samson Cordage Wks.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbine & Water Wheels.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Pelton Water Wheel Co.
Stilwell-Bierce Smith-Valle

Universities.
Rose Polytechnic Inst.
Worcester Polytechnic Inst.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wire, Bare.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Washburn & Moen Mfg. Co.
Western Electric Co.

Woodwork, Electrical.
Cabinet Mfg. Co.

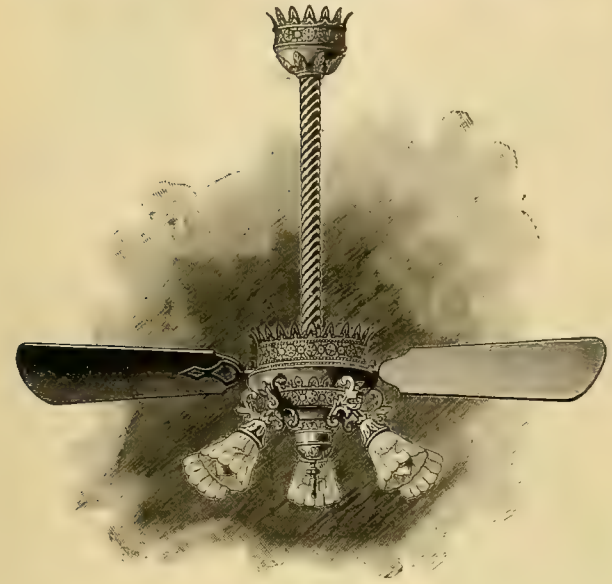
X Ray Outfits.
Central Electric Co.
Commercial El. Supply Co.
Queen & Co.

Zincs.
Beattie Zinc Works Co.

For Alphabetical Index of Advertisements See Page III.

DIEHL FANS

FOR ALL CIRCUITS, EXCEPT ALTERNATING.

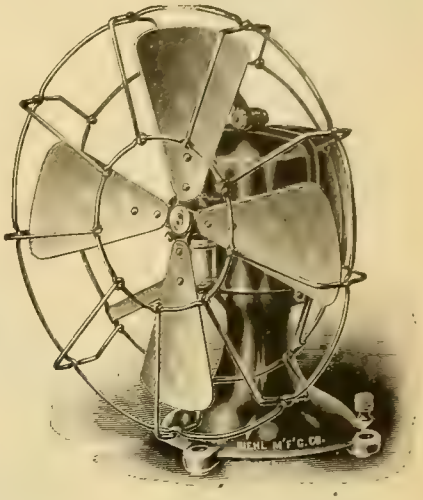


OUR CEILING FANS AND ELECTROLIERS
ARE THE

Recognized Standard
OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency
Of Any on the Market.



WRITE FOR CIRCULARS AND PRICES
ON

Ceiling Fans—Column Fans—Counter Column Fans—Desk Fans—Bracket Fans—Exhaust Fans.

Showrooms: NEW YORK: 561-563 Broadway.
CHICAGO: 192-194 Van Buren St.
BOSTON: 128-132 Essex St.

DIEHL MANUFACTURING CO.,
ELIZABETHPORT, N. J.

"DURO"

Telephone Cords . . .
Switchboard Cords . .
Medical Battery Cords.

THE ONLY practical method yet devised to tip a Flexible Conductor using the full strength of the covering is that employed in the

"Duro" Telephone Cord

(Shell Removed.)

ALL other devices **fail** to hold, but that hook is **positive!**

The Conductor, Shell and Pin are all soldered together and therefore **cannot** come apart. Why not use **the Best?**

MANUFACTURED BY

CHARLES H. McEVOY,
LOWELL, MASS.

W. E. FAN MOTORS. LAKON TRANSFORMERS.

THE RECOGNIZED STANDARD.

INTERIOR
Iron armored, brass armored and plain
CONDUIT.
Conduit fittings and tools for conduit work.

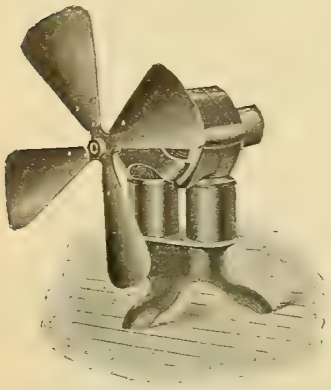
A LARGE SUPPLY CARRIED IN STOCK

And Prices Attractive.

WESTERN ELECTRIC COMPANY,
Exclusive Agents,

CHICAGO. NEW YORK.

THE HYDRO-ELECTRIC FAN!

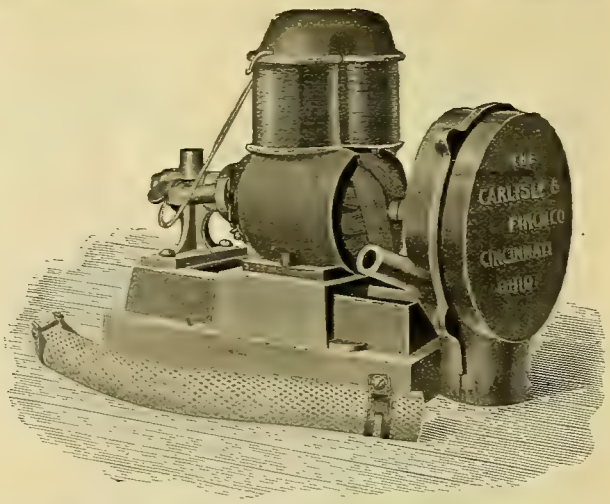


SOMETHING NEW.

Will Run on 40 Pounds Water Pressure or Over.

SPEED OF FAN 1800.

WRITE FOR CIRCULAR "C."



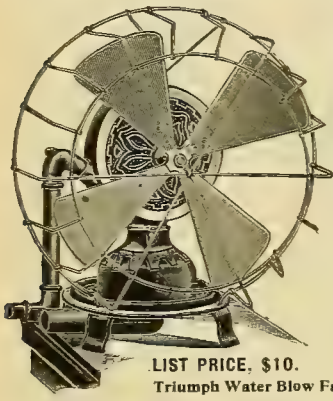
The Carlisle & Finch Co.,

832 West 6th Street,

CINCINNATI, OHIO.

State Water Pressure.

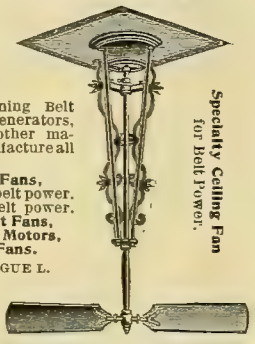
THE ELECTRICIAN'S BEST FRIEND.



Our Fans and Motors are in your line. You sell them and get a new customer. Our Water Motors are the most powerful and are used for running Belt Fans, Telephone Generators, Coffee Mills and other machinery. We manufacture all kinds of fans.

Triumph Water Fans, Ceiling Fans for belt power. **Floor Fans** for belt power. **Triumph Exhaust Fans, Specialty Water Motors, Electric Ceiling Fans.**

SEND FOR CATALOGUE L.



Specialty Ceiling Fan for Belt Power.

SPECIALTY MFG. COMPANY,

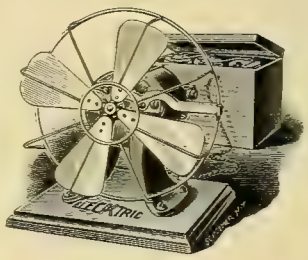
361 TO 367 S. MERIDIAN STREET,

INDIANAPOLIS, IND.

LIST PRICE, $10.

Triumph Water Blow Fan. (Pat. applied for.)

BATTERY FAN OUTFITS



KNAPP MOTORS.
GORDON CELLS.

Complete with cabinet, connecting cords, etc.

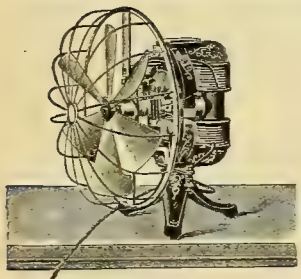
150 HOURS

before renewing the battery. 6 inch, 8 inch and 10 inch Fans. 1898 models.

GORDON-BURNHAM BATTERY CO.,

DEPARTMENT 3,

594 Broadway, NEW YORK.

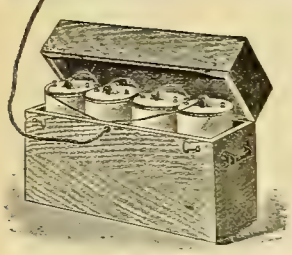


Edison 9-inch Battery Fan Outfit.....

MOTOR WITH BALL BEARINGS.

The most economical and efficient battery fan motor on the market.

WRITE FOR CATALOGUE.



EDISON MFG. COMPANY,

THOS. A. EDISON, Proprietor.

FACTORY: ORANGE, N. J.

St. James Building, Broadway and 26th Street,

NEW YORK.

GORDON PRIMARY CELL.

For Open and Closed Circuit Work.

The Perfect, Modern, Longest Lived and Most Economical Cell Ever Put on the Market.

In use by the leading cities, railroads, telephone and gas engine companies.

WE CLAIM:—Constant discharge of current without polarization; no local action; no noxious gases or fumes; no acids; least labor for operation; cleanest; not freezing at 28° below zero; economic value 50 per cent. greater than gravity cell, and 30 per cent. greater than best other cell in market. For No. 1 cell, 250 ampere hours; for No. 2 cell, 100 ampere hours; on open circuit, .9 to 1 volt; on closed circuit, .65 to $\frac{15}{16}$ volt. Send for circular and price list.

THE GORDON-BURNHAM BATTERY CO.,

82 to 86 West Broadway, New York City.

GEO. W. PATTERSON, 1539 Marquette Bldg., Chicago, Ill.

Motors-Dynamos

NORTHERN ELECTRICAL MFG. CO.,

Chicago Office, 1602 Monadnock. MADISON, WIS.

THE S-W

Arc Light Radiators

BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.

Diffuses light uniformly.

Easily attached and detached.

Can be cleaned without removal and are practically indestructible.

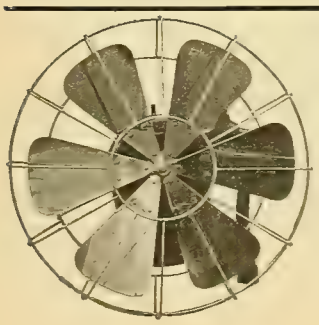
Made for all styles of arc lamps.

Send for descriptive circular and prices.

General Agency: Chicago General Fixture Co., 169 Adams Street, Chicago, Ill.

Shadowless Radiator Mfg. Co.,

FARIBAULT, MINN.



The Gem Water Motor Fan.

Novel in Construction.
As Easily Installed as an Electric Fan Motor.
Discounts for Exclusive Agents. Correspondence Solicited.

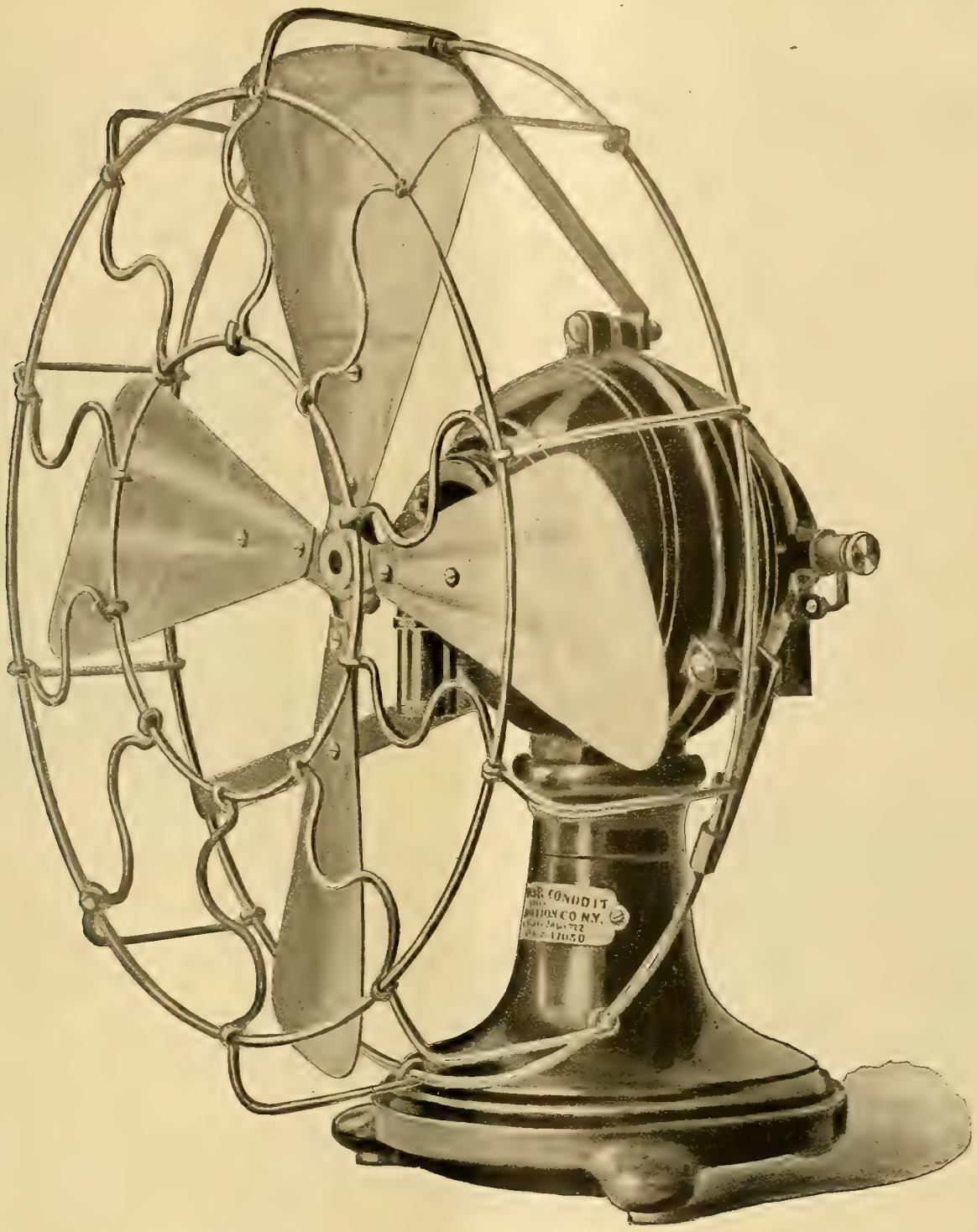
Simple, Economical, Effective, Noiseless.
List Price, $10.00.

JUST THE THING FOR SUPPLY HOUSES TO CARRY.

Agents Wanted.

THE SCHNEIDER MFG. CO., 1139 Hamilton Street, CLEVELAND, OHIO.

McGILL & POMEROY, 321 Dearborn St., Chicago, Ill., Agents for Indiana, Illinois, Missouri, Iowa, Wisconsin, Michigan.



1898 **Lundell Fan Motors.** 1898

Advance orders, greatest in the history of the business, attest the popularity of these motors. They are the world's standard. '98 styles are—some of them—new. '98 prices are lower than ever.
Catalogue—second edition—just out.

SPRAGUE ELECTRIC COMPANY,

CHICAGO—Marquette Building. NEW YORK—20 Broad Street.

J. E. KEELYN, President and General Manager. D. A. HOLMES, Vice-President. B. F. STEWART, Secretary. H. C. DODGE, General Superintendent.

WESTERN TELEPHONE CONSTRUCTION CO.,

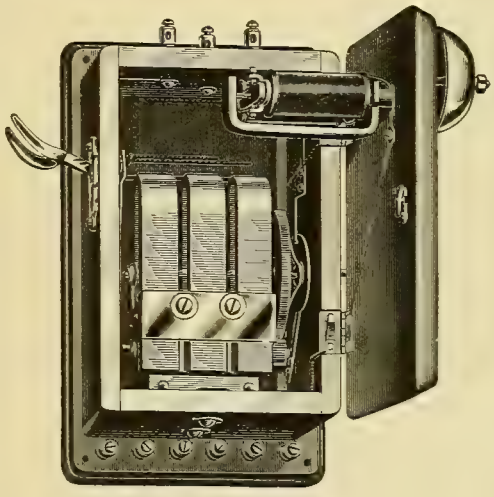
250 SOUTH CLINTON STREET, CHICAGO, ILL.

MANUFACTURERS OF HIGH GRADE EXCHANGE AND TOLL LINE EQUIPMENT.

Switchboards, Combined Lightning Arrester, Distributing and Change Boards, Series and Bridging Telephones, Cabinet Desk Sets, Magneto Bells, Repeating Coils, Receivers and Transmitters, all of new and improved type. Correspondence solicited.

SWITCHBOARDS FOR ALL.

Multiple Transfer Switchboards for use in large exchanges. Switchboards to replace inferior makes. Combined Toll Line and Exchange Switchboards. Switchboards for those who manufacture telephones. Switchboards for those who desire to add to their present equipment. Switchboards for dealers in electrical supplies. Switchboards of any special design.



MAGNETO BELLS FOR THE TRADE.

Highest efficiency; moderate price. Equipped with Quadripolar Ringer Magnets, Centrally Pivoted Armatures, Platinum Contact Switch Hooks, New Style Armatures, Wide Cut Cog Gears, Best Automatic Shunts ever devised. Our new Bells are superior to any on the market by wide margin and must be inspected and tested to be thoroughly appreciated.

SPECIAL ANNOUNCEMENT.

Largest contract of the year has just been awarded to Western Company for Central Office Equipment for the Newark, N. J., Exchange System, calling for Switchboards having capacity for upwards of 3,100 numbers.

WRITE FOR CIRCULAR DESCRIBING MULTIPLE TRANSFER BOARD TO BE INSTALLED IN NEWARK MAIN CENTRAL OFFICE.

Important Telephone Books.

THE TELEPHONE HANDBOOK. By Herbert Laws Webb. 16mo, 150 pp. Price $1.00.
This handbook is a complete treatise on telephony, and a practical book on telephone working and management, based entirely on standard American practice. It is extremely useful to telephone inspectors and operators.

PATENTED TELEPHONY. A Review of the Patents Pertaining to Telephones and Telephonic Apparatus. Published by the American Electrical Engineering Association. Cloth bound; fully illustrated. Price $1.50.

THE ELECTRIC TELEPHONE. By E. J. Houston, Ph. D., and A. E. Kennelly, Sc. D.; 12mo, cloth, 422 pp., 142 illustrations. Price $1.00.
This book describes the construction of the various forms of transmitting and receiving devices, the signalling mechanisms, and the switchboard apparatus at the central station. It is written by two well-known electricians, and has the merit of being the latest work on the subject.

THE PRACTICAL TELEPHONE HANDBOOK. By Joseph Poole, A. I. E. E. Second edition, revised and enlarged. 360 pp. 288 illustrations. Price $1.50.
In this work the writer has endeavored to produce a manual of moderate size and cost, but thoroughly practical, and detailing, as far as space will allow, the most recent methods of telephone working. While the requirements of telephone employes have been kept constantly in view, it is fully intended also that the book shall be of service as a source of information on telephonic matters to users of the telephone and to the public generally.

TELEPHONE TROUBLES AND HOW TO FIND THEM. A complete handbook for telephone inspectors. By W. Hyde and J. H. McManman, edited by Prof. C. H. Haskins. Sixth edition. 16mo, 50 pp. Price 25 cents.
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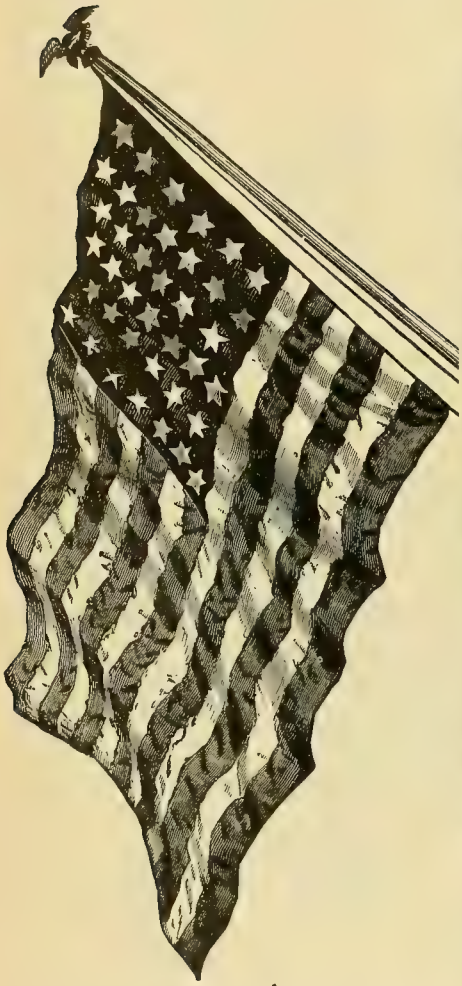

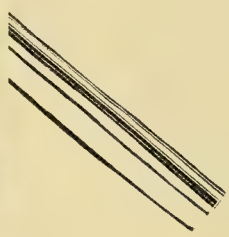

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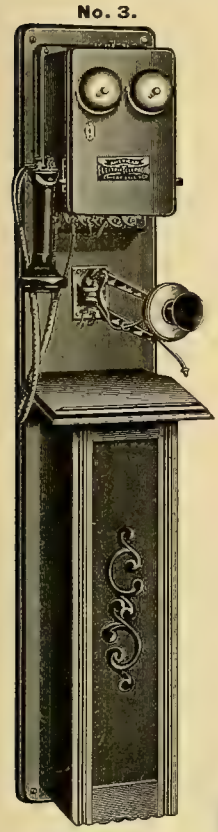

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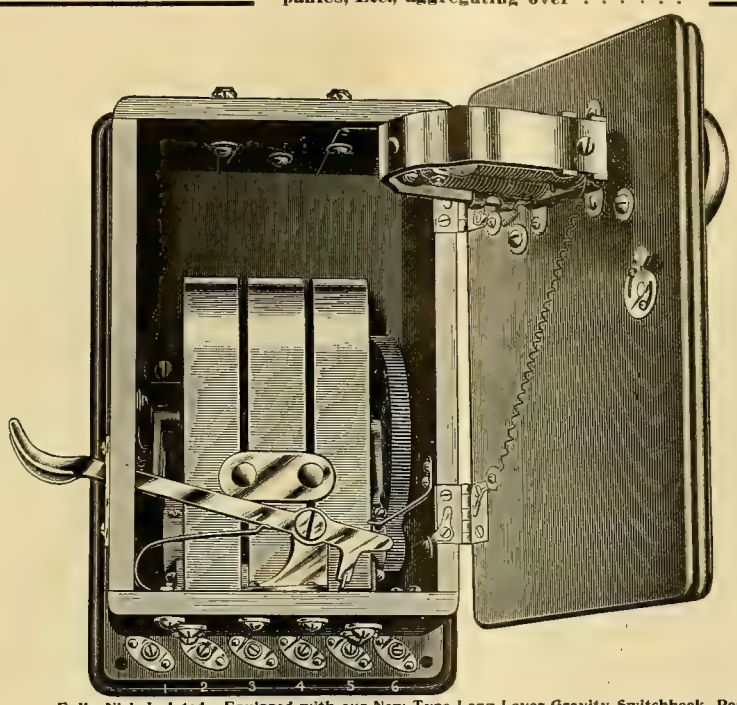

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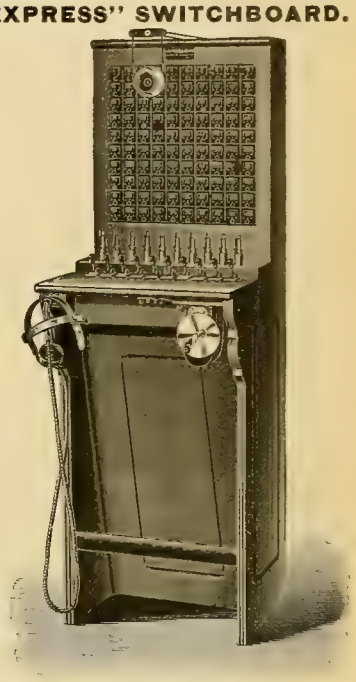

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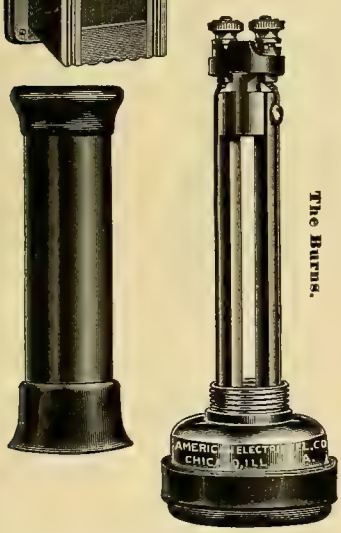

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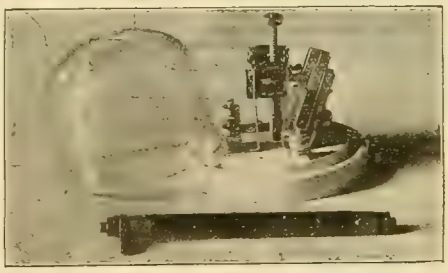

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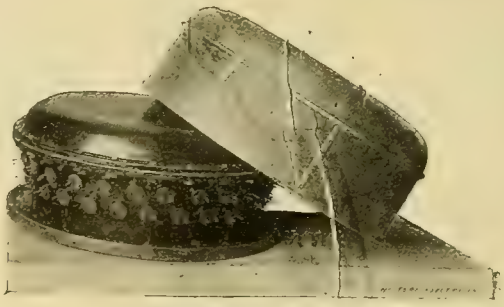

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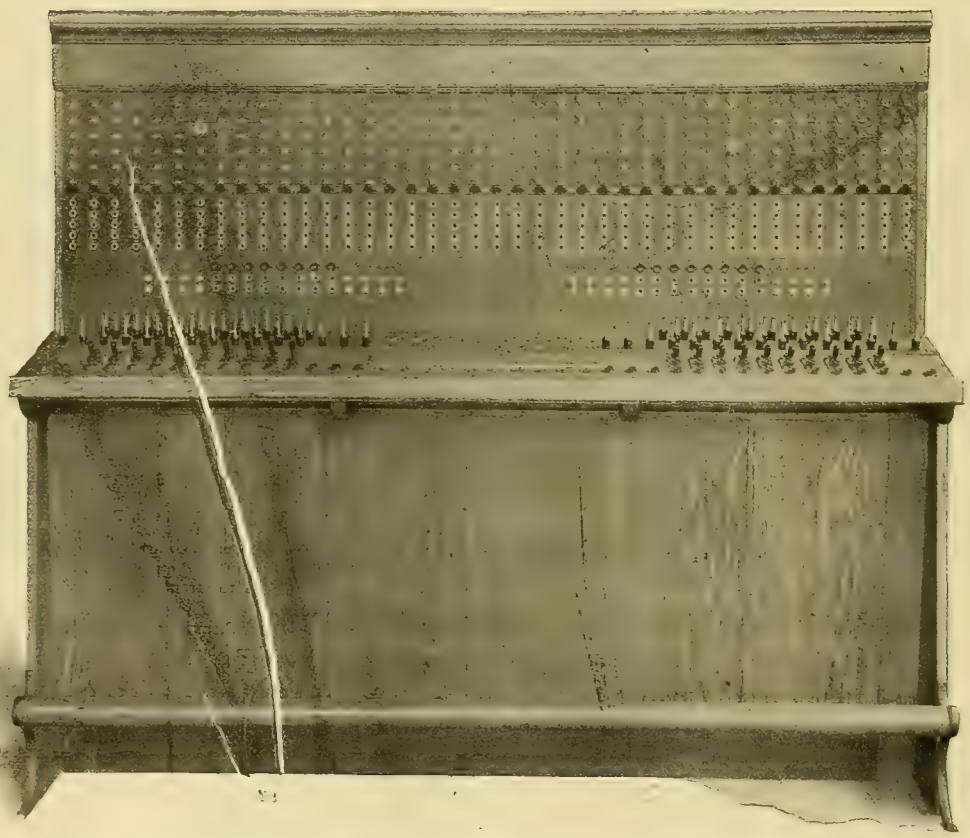

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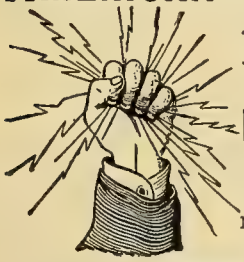

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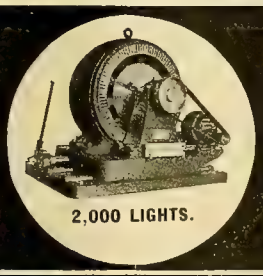

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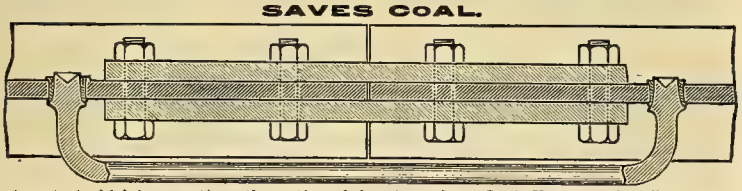

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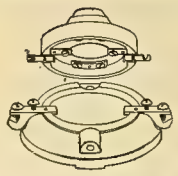

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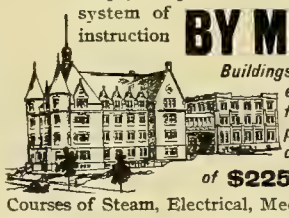

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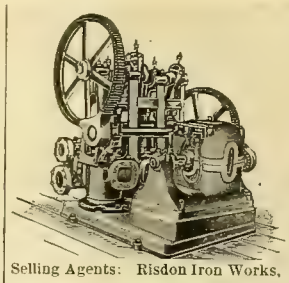

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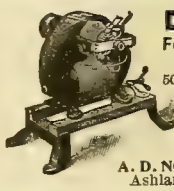

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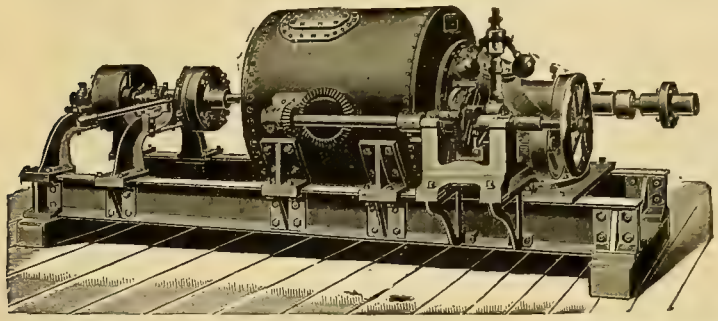

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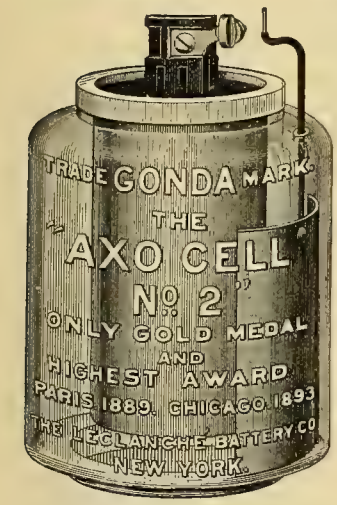

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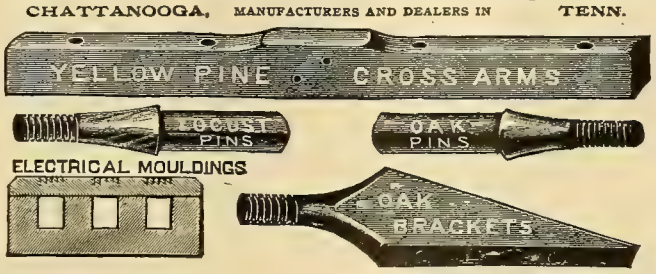

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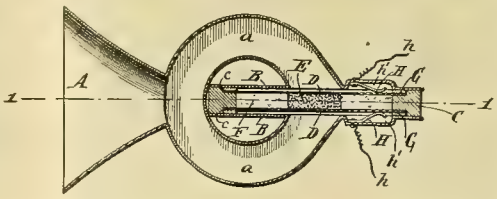

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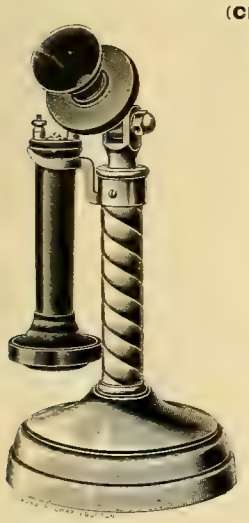

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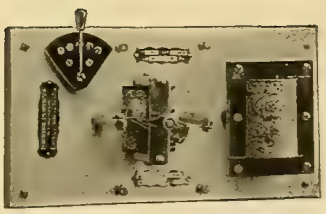

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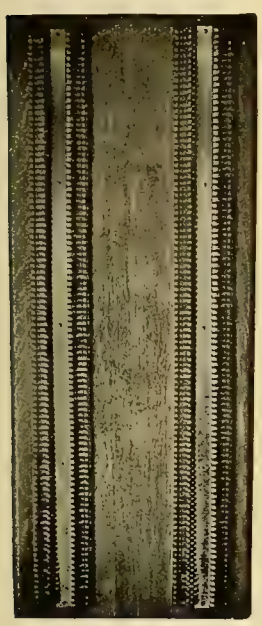

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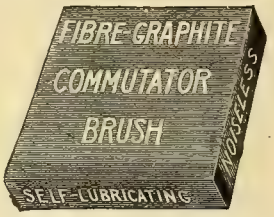

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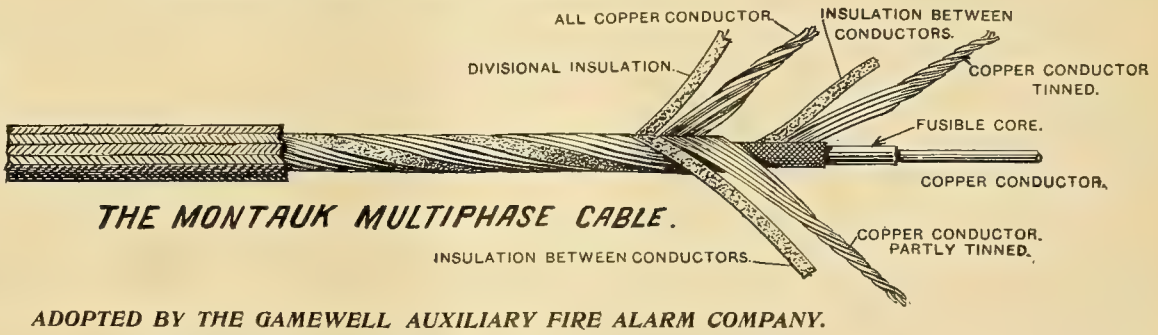

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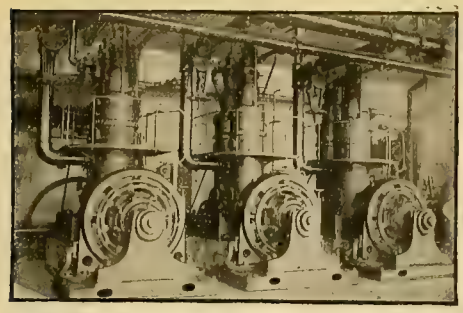

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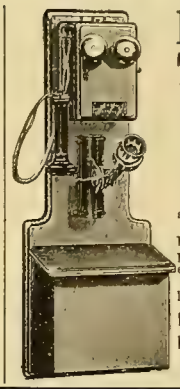

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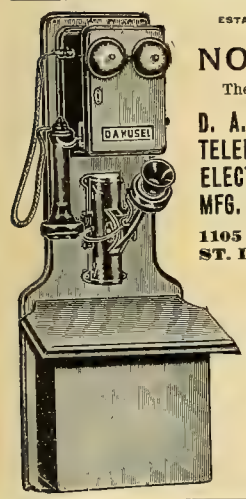

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The Motor Engineers' and Electrical Workers' Hand-Book is compiled with a view of furnishing a book of reference in a simple and convenient form for the use of motor engineers and street railway men. The diagrams of controller connections and combinations will be found of great value in practical work. The methods of testing are both simple and reliable. The writer is indebted to the Westinghouse, General Electric, Walker and Steel Motor companies for information cheerfully furnished.

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Chapter I.—Elementary Principles. Units, Ohm's Law, Watt, Kilowatt, Ampere, Turn, Hour, etc. Potential, E. M. F., Voltage, Drop of Potential, Resistance (Ohmic), Conductivity. **Chapter II.**—Magnetism and Electro-Magnetic Induction. **Chapter III.**—Circuits: Varieties of Circuits, Series, Shunt, Parallel or Multiple Arc, Joint Resistances of Parallel Circuits, Multiple Series, Series Multiple. **Chapter IV.** Dynamo Electric Machine. General Principles, Field Windings, (Varieties), Series, Shunt, Compound, etc. Short Shunt, Long Shunt. **Chapter V.**—Instructions for Operating Generators: Running a Single Generator, To Shut Down a Machine Not Run in Multiple, Sparking, Polarity, Excitation Grounds, Generators in Multiple, Connections, Running Generators in Multiple. To Shut Down a Machine Running in Multiple. **Chapter VI.**—The Electric Motor: General Principles, Counter Electromotive Force and Mechanical Power, Efficiency. **Chapter VII.**—Measurements and Tests of Street Railway Motors—Faults, Measurement by Drop of Potential Method (Examples), Insulation Tests, Voltmeter Method, Description of Voltmeter and Ammeter, The Wheatstone Bridge, Instructions for Operating, Drop of Potential in Motor Circuits. **Chapter VIII.**—Instructions for Operating Car Apparatus: Brushes, Sparking at Brushes, Bearings, Bucking, Fuse, Block, Operating Car, Trolley, etc. **Chapter IX.**—The Electric Motor Car in Detail. Series, Parallel, Controller, Reverse Switch, Rheostat, Fuse Box, Lightning Arrester, Heaters. **Chapter X.**—Definitions of Terms. **Chapter XI.**—Diagrams of Car Wiring and Controllers, with Written Descriptions and Diagrams of Combinations: Westinghouse System (G. No. 14, No. 28 and 28 A). General Electric (K, with W. P. Machines, K 2; General Electric Series Parallel Controller with Magnetic Brake). Walker System (B2, E) Steel Motor Co. System. **Chapter XII.**—General Electrical and Mechanical Information. Belting, Shafting, Pulleys and Gears, Melting Point, Specific Gravity and Relative Conductivity, Table Comparing Wire Gauges, Number, Dimensions, Height, Length and Resistance of Pure Copper Wire, Electrical Units and Formulas, Equivalent Carrying Capacity, Proportions of Gear Teeth, Notes, Bill of Material for Span Wire Construction (Single Track) (Double Track), Bracket Construction, (Single Track) (Center Pole) (Double Track).

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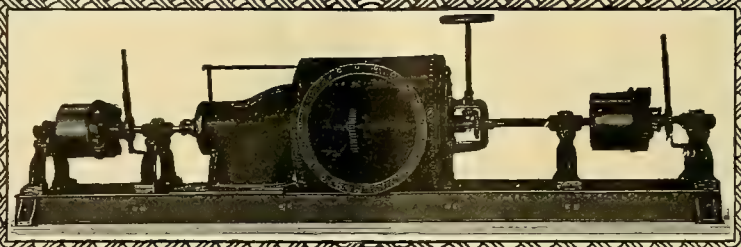

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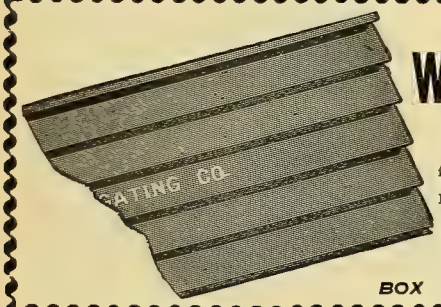

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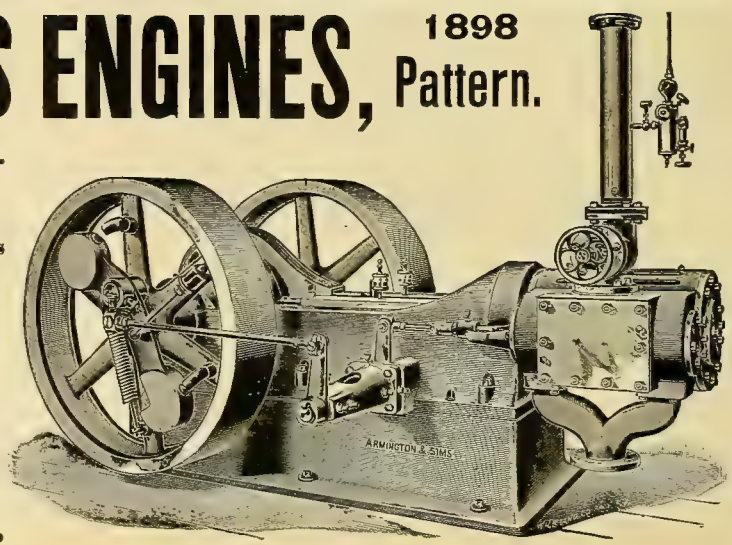

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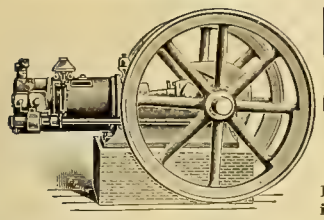

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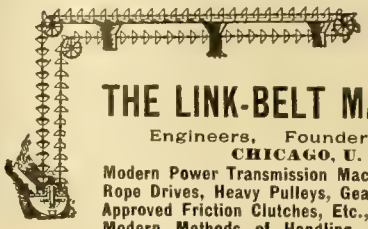

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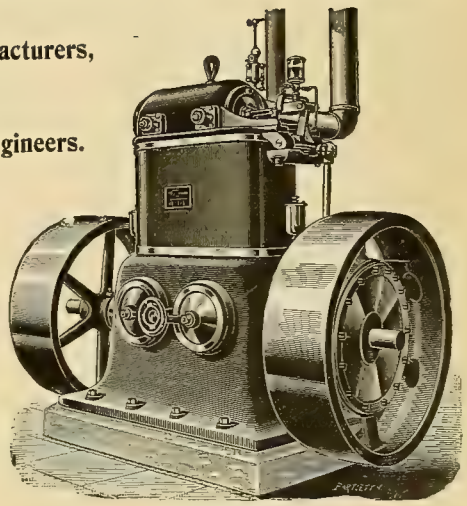

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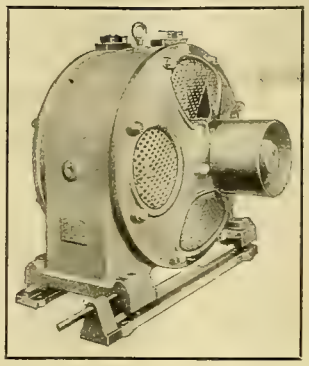

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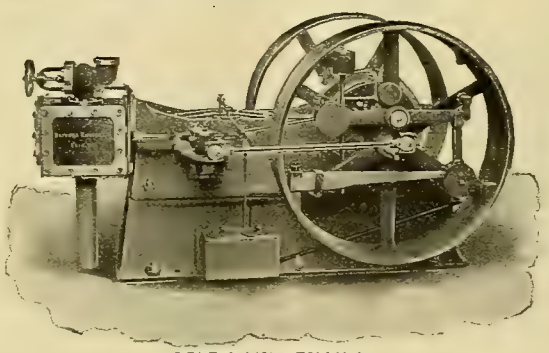

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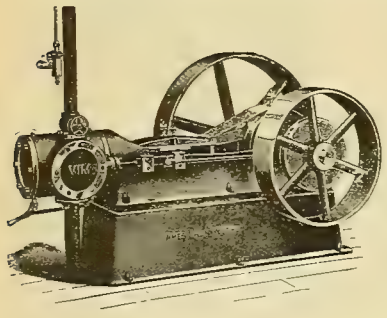

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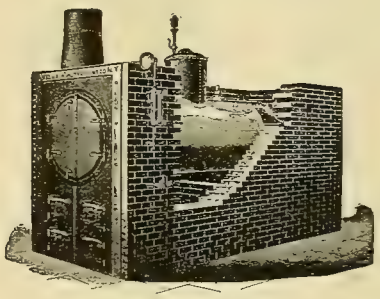

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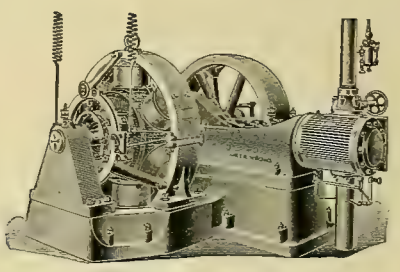

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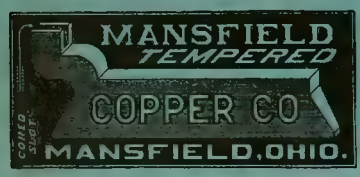
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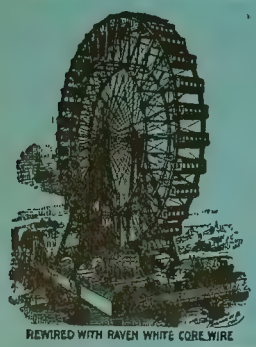
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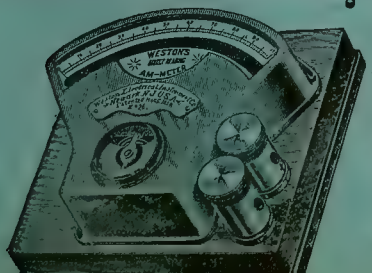

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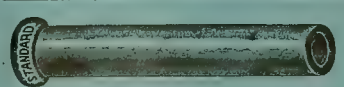

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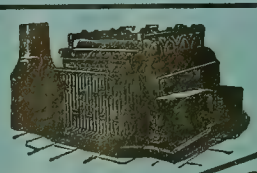

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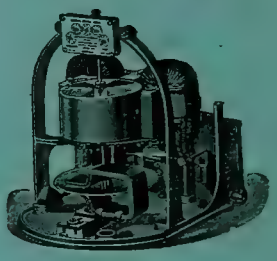

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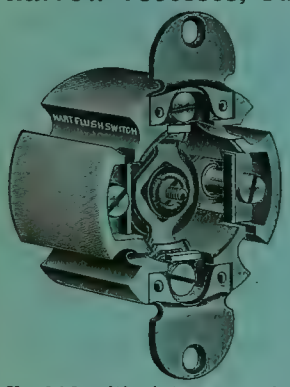

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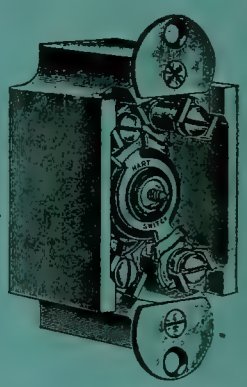

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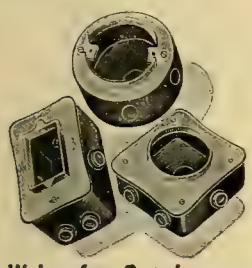

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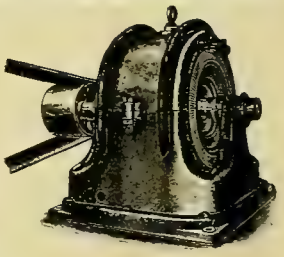

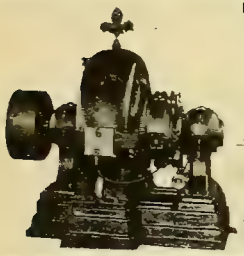

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Are absolutely of the Highest Grade, and cannot be equalled. See that every Carbon bears our TRADE MARK

Special Carbons for Long-Burning Arc Lamps.
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It's the Hundreds

of articles of detail in a telephone system between the switchboard and the subscriber that we can supply you from Chicago stock.

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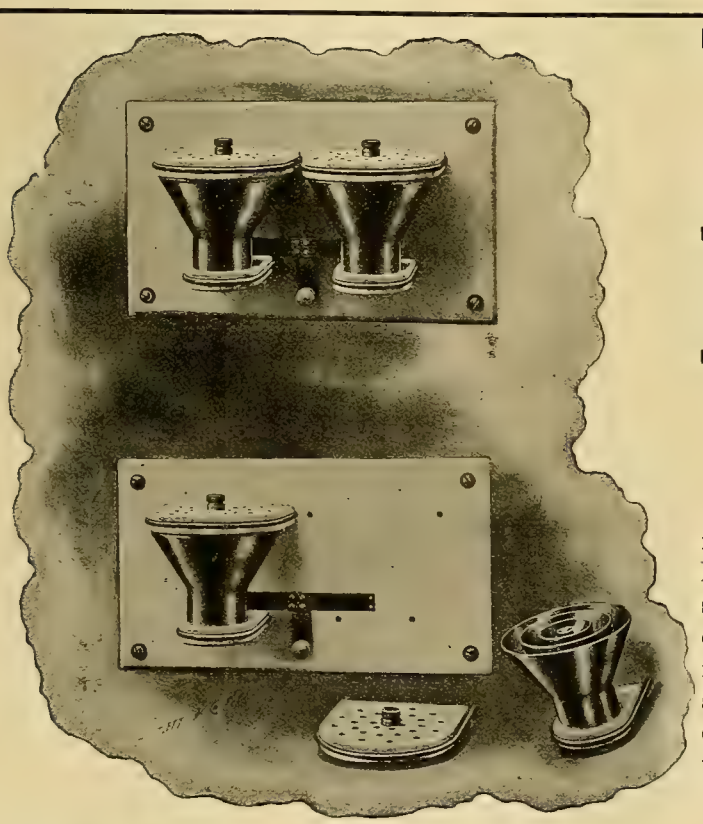

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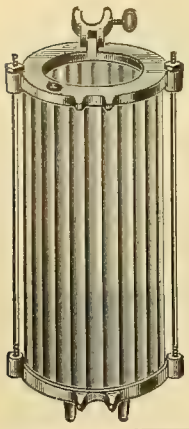

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Easily attached and detached.
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Made for all styles of arc lamps.
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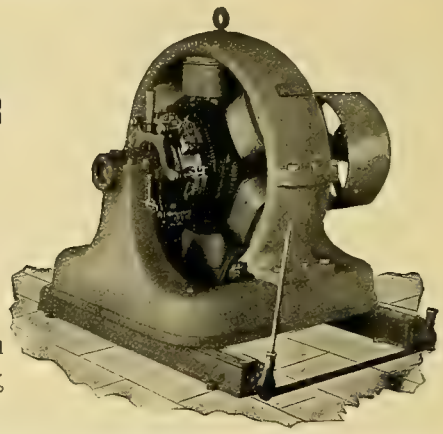

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Electric Storage Battery Co.
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For Alphabetical Index of Advertisements See Page III.

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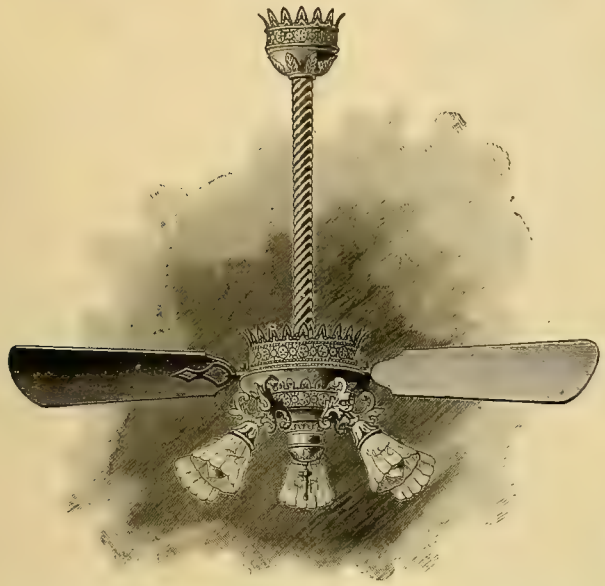
FOR ALL CIRCUITS, EXCEPT ALTERNATING.

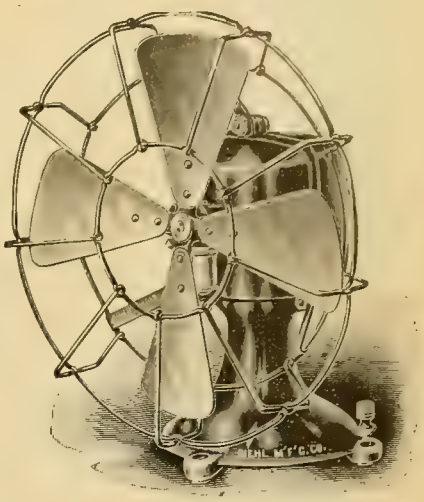


OUR CEILING FANS AND ELECTROLIERS
ARE THE

Recognized Standard
OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency
Of Any on the Market.



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ON

Ceiling Fans—Column Fans—Counter Column Fans—Desk Fans—Bracket Fans—Exhaust Fans.

Showrooms: NEW YORK: 561-563 Broadway.
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ELIZABETHPORT, N. J.

INCANDESCENT LAMPS 12 cents.

Now is the time to get your burned out lamps together and have them renewed or turned into cash. We have now repaired over 700,000 lamps, and nine out of ten of our shipments are to old customers.

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We are now pleasing central station managers by supplying a uniform and efficient lamp at a price that makes it profitable to replace lamps every 600 hours or oftener.

The renewal of lamps makes this possible.

If you prefer new lamps, we can supply you with the best and allow you three cents each for your burned out lamps.

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LYNN, MASS.

W. E. FAN MOTORS. LAKON TRANSFORMERS.

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Iron armored, brass armored and plain

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Conduit fittings and tools for conduit work.

A LARGE SUPPLY CARRIED IN STOCK

And Prices Attractive.

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CHICAGO. NEW YORK.

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..MANUFACTURER OF..

"New Standard" Open Circuit Batteries,

OF EVERY DESCRIPTION.

259 GREENWICH STREET, NEW YORK.

The brightest Telephone Men, Electrical Constructors and Physicians all over know now there are none just as good as

"NEW STANDARD" DRY BATTERIES.

Will give any one a race on prices. The quality stands alone.

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Ceiling Fans for belt power.
Floor Fans for belt power.
Triumph Exhaust Fans,
Specialty Water Motors,
Electric Ceiling Fans.

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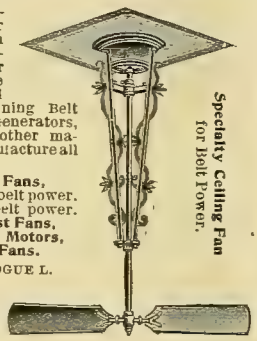

Specialty Ceiling Fan for Belt Power.

SPECIALTY MFG. COMPANY,

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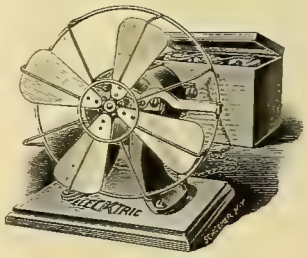
LIST PRICE, $10.

Triumph Water Blow Fan. (Pat. applied for.)

YOU CAN STOP



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150 HOURS

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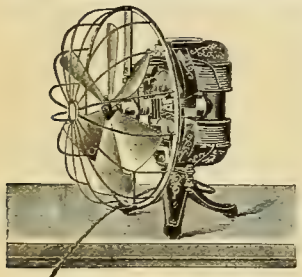

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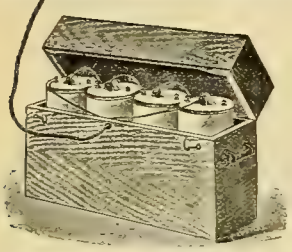

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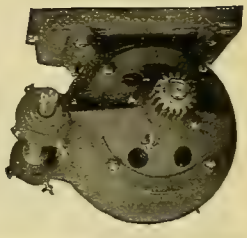

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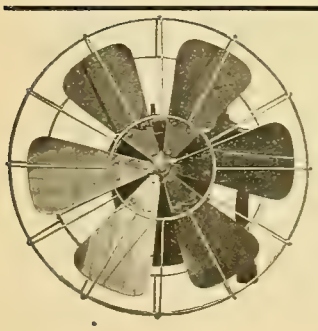

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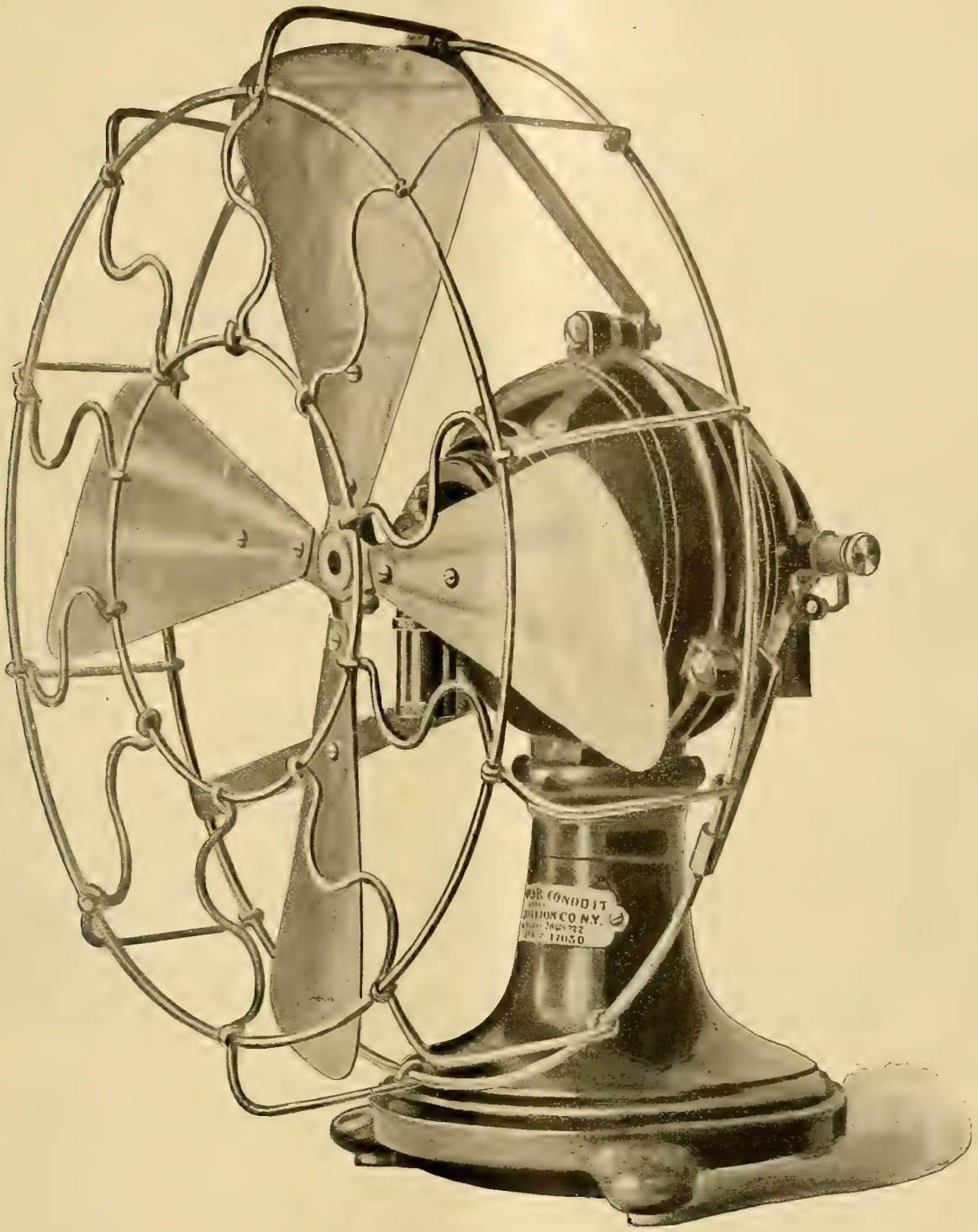

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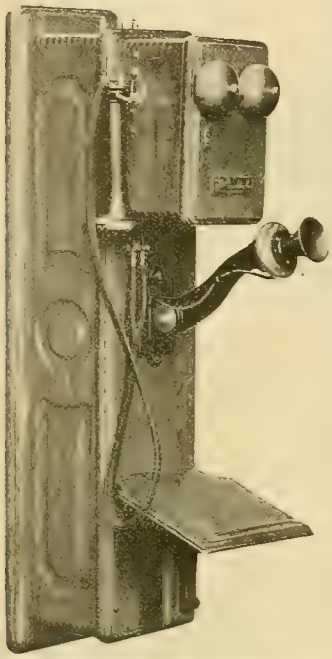

Has been especially designed for long distance and exchange work, where a strictly first-class instrument is desired. This instrument is guaranteed to work and give good results over any line over which it is possible for a telephone to work.

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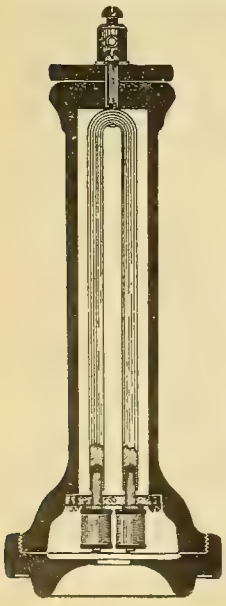
The Generator and Ringer are made after the most approved designs, with best possible material and workmanship that can be procured for the purpose, and are guaranteed to give a strong ring through 15,000 ohms resistance.

The Victor Transmitter is of the long distance type, and mounted on an adjustable arm.

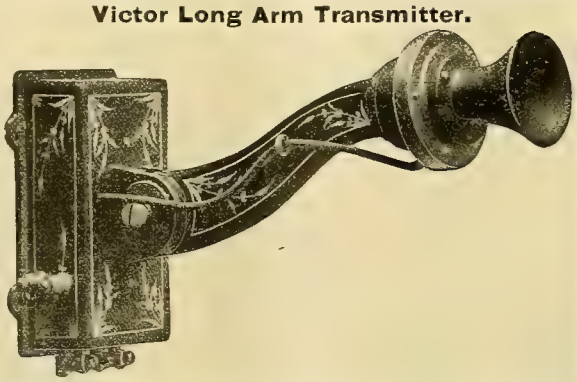
The Victor Special Double Pole Receiver has hard rubber shell, compound magnets and is fitted with special device for keeping the adjustment.



Victor Double Pole Receiver.

This instrument is designed to give the very best results obtainable in a telephone receiver. It has powerful compound magnets assembled in a genuine hard rubber case, and fitted with our special device for keeping the poles constantly in the same position with the diaphragm. The spools are wound with No. 35 silk covered wire. All connections are soldered and thoroughly insulated. Price no higher than the ordinary single pole type.

Victor Long Arm Transmitter.



The box and arm are neat in design, highly finished and ornamented. It is very sensitive, powerful and clear in articulation. The transmitter head is made of hard rubber, so as to prevent the absorption of moisture and the consequent packing of the granules, a fault so often found in wooden transmitters. Over 10,000 in use. These instruments have 500 ohms induction coil.

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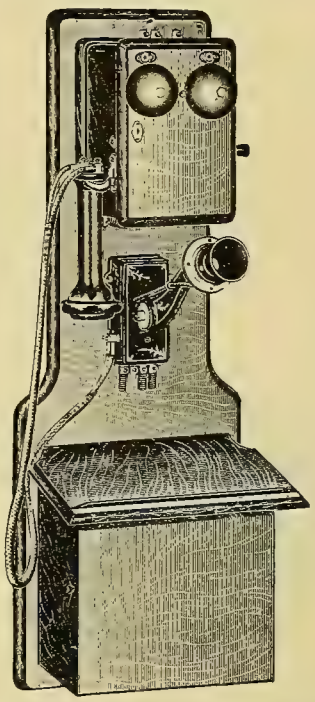
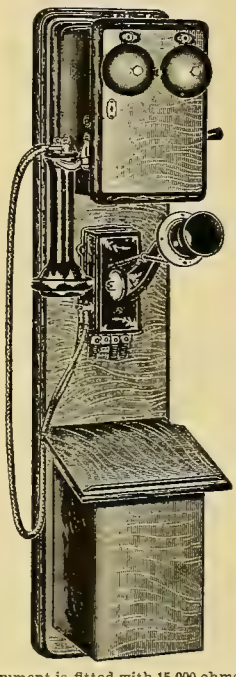
STYLE "C."



This instrument is fitted with 15,000 ohms generator, 500 ohms induction coil, our special double pole receiver, long distance arm transmitter. This is the best and most popular exchange telephone in the market.

STYLE "D."



This instrument is fitted with 15,000 ohms generator, 500 ohms induction coil, our special double pole receiver, long distance arm transmitter. A very powerful instrument, and one that gives entire satisfaction.

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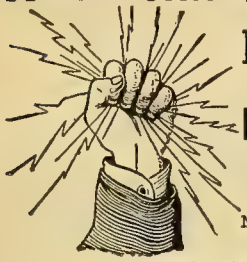

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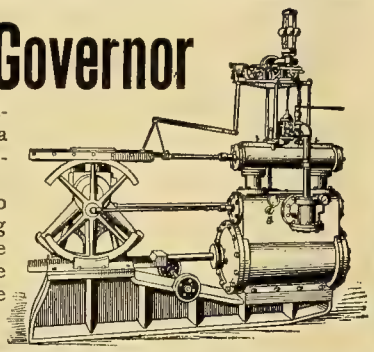

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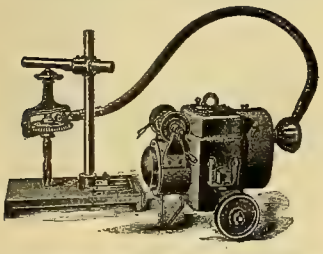

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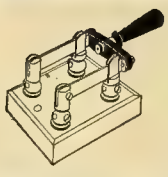

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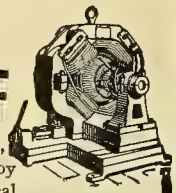

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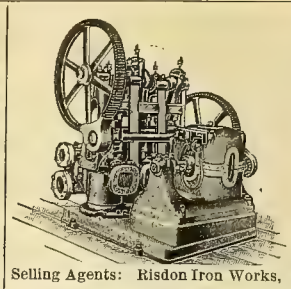

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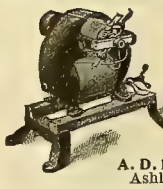

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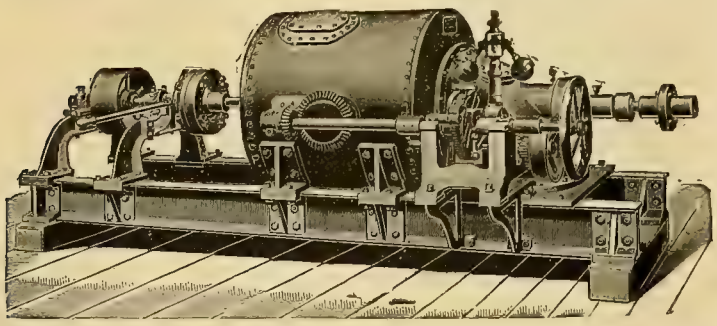

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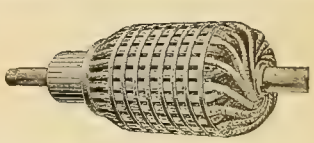

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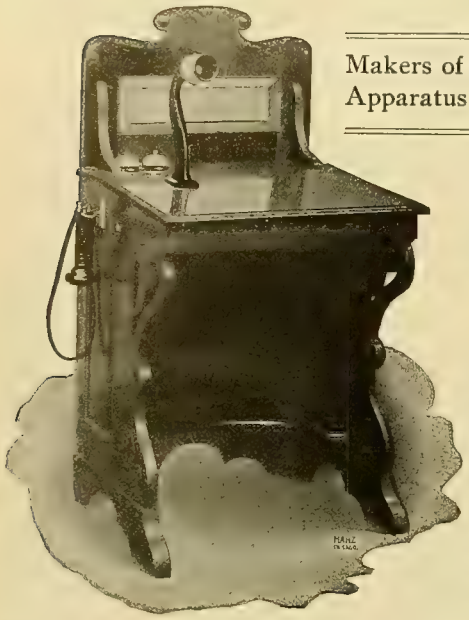

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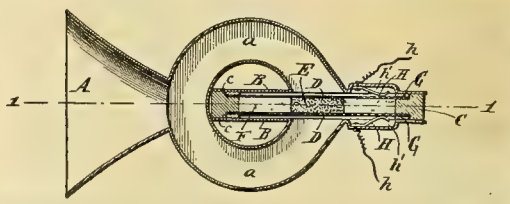

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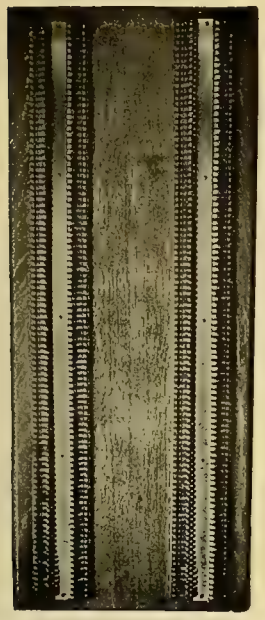

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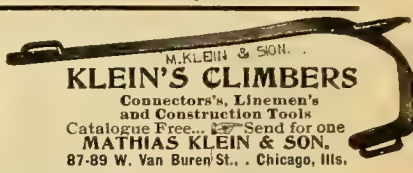

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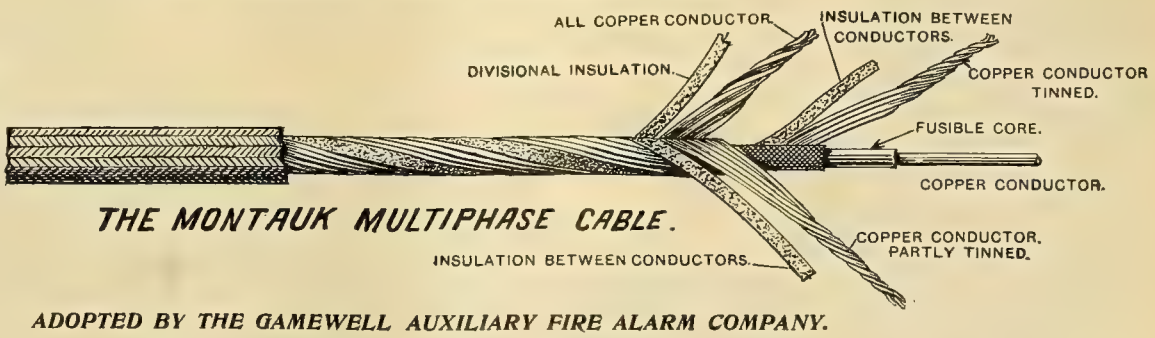

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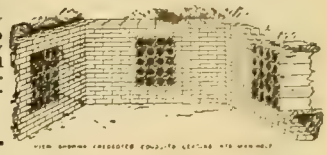

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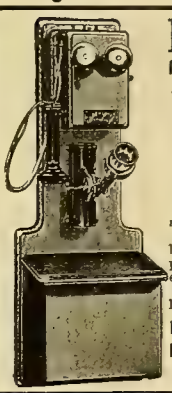

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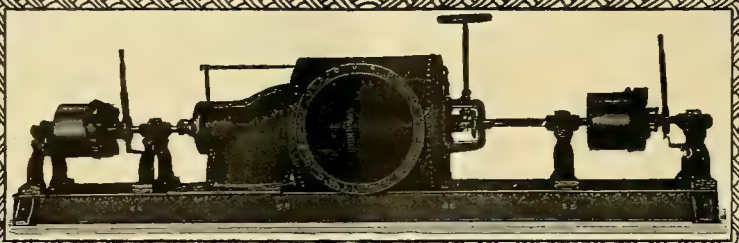

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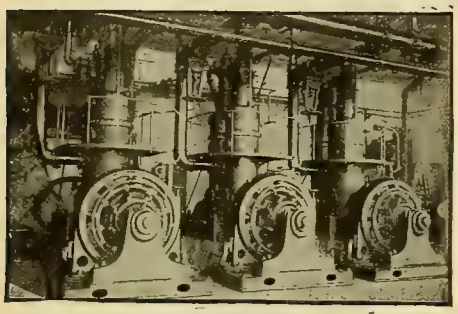

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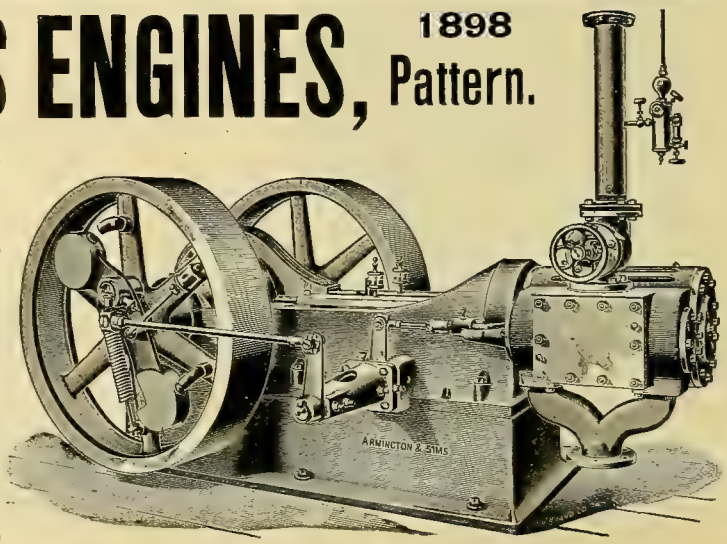

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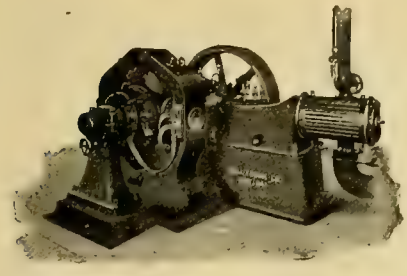

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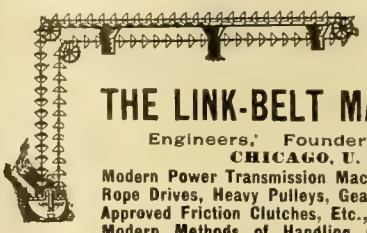

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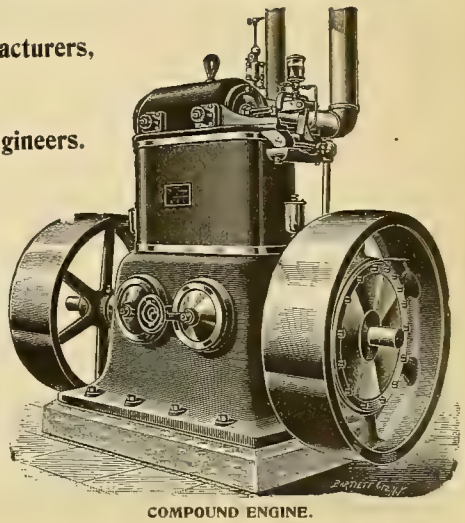

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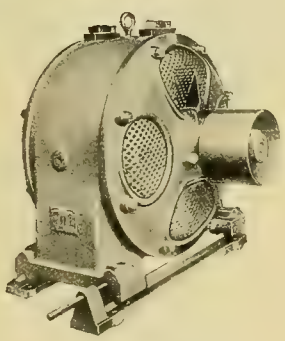

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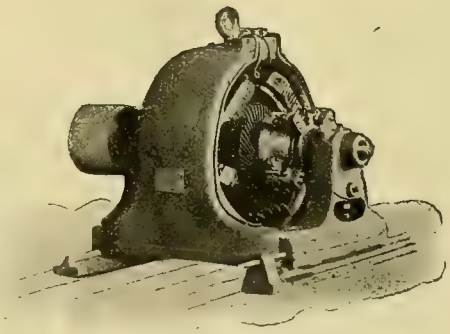

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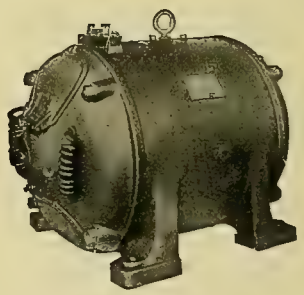

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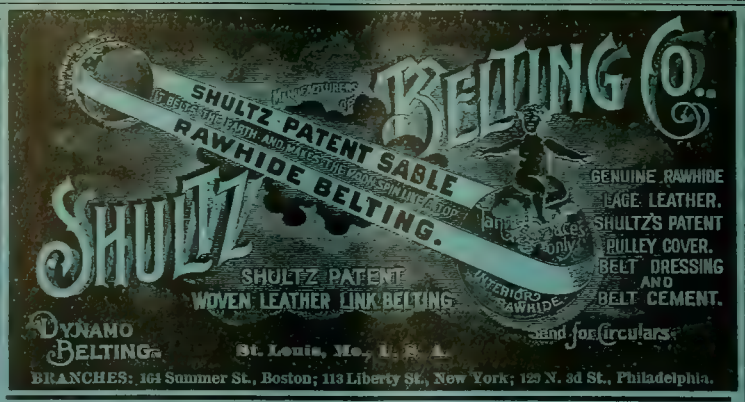

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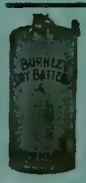

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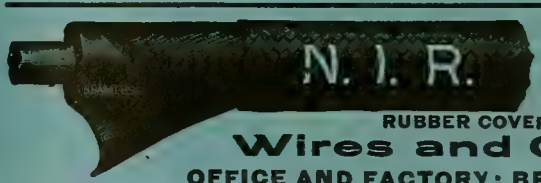

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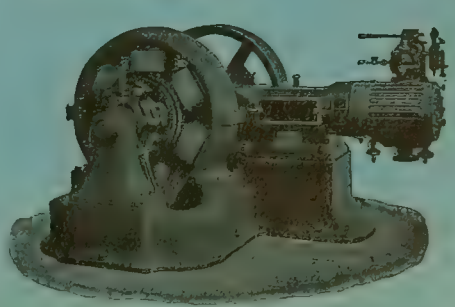

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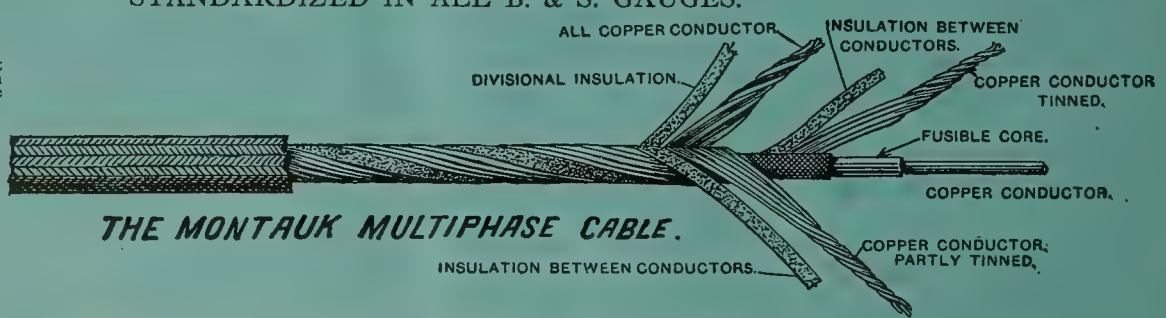

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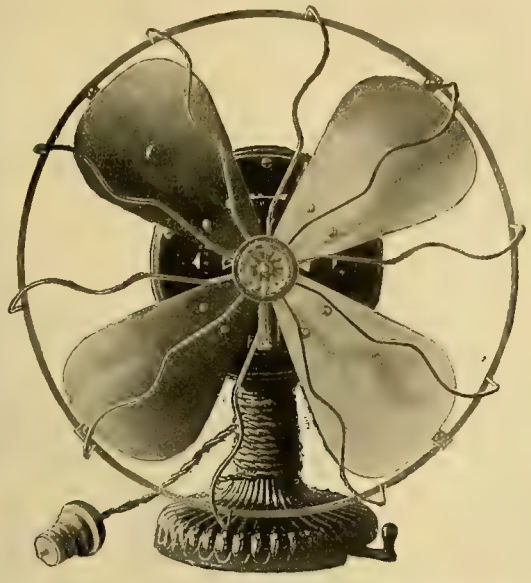

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If so, write us for particulars.

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We having received a very large shipment of

CORED CARBONS

Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

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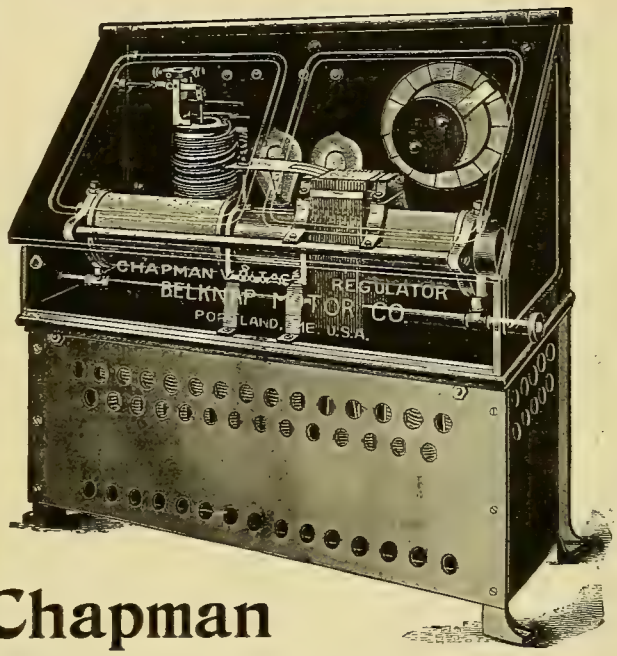

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insure **Steady Light** from unsteady power.
For use with Steam or Water Plants.
—**No Attendance Required.**—
Regulator sent on 30 days' trial.
Let us show what it can do for you.

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This meter requires no knowledge of electricity to erect.
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This meter requires no lubrication.
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This meter is direct reading, having no multiplier.
This meter does not require one-thousandth of a horse power.
This meter will operate for years without opening.
This meter has no springs, jewels or frictional errors.
This meter once right is always right.

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For Enclosed Arcs.

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THE NATIONAL CARBON CO.

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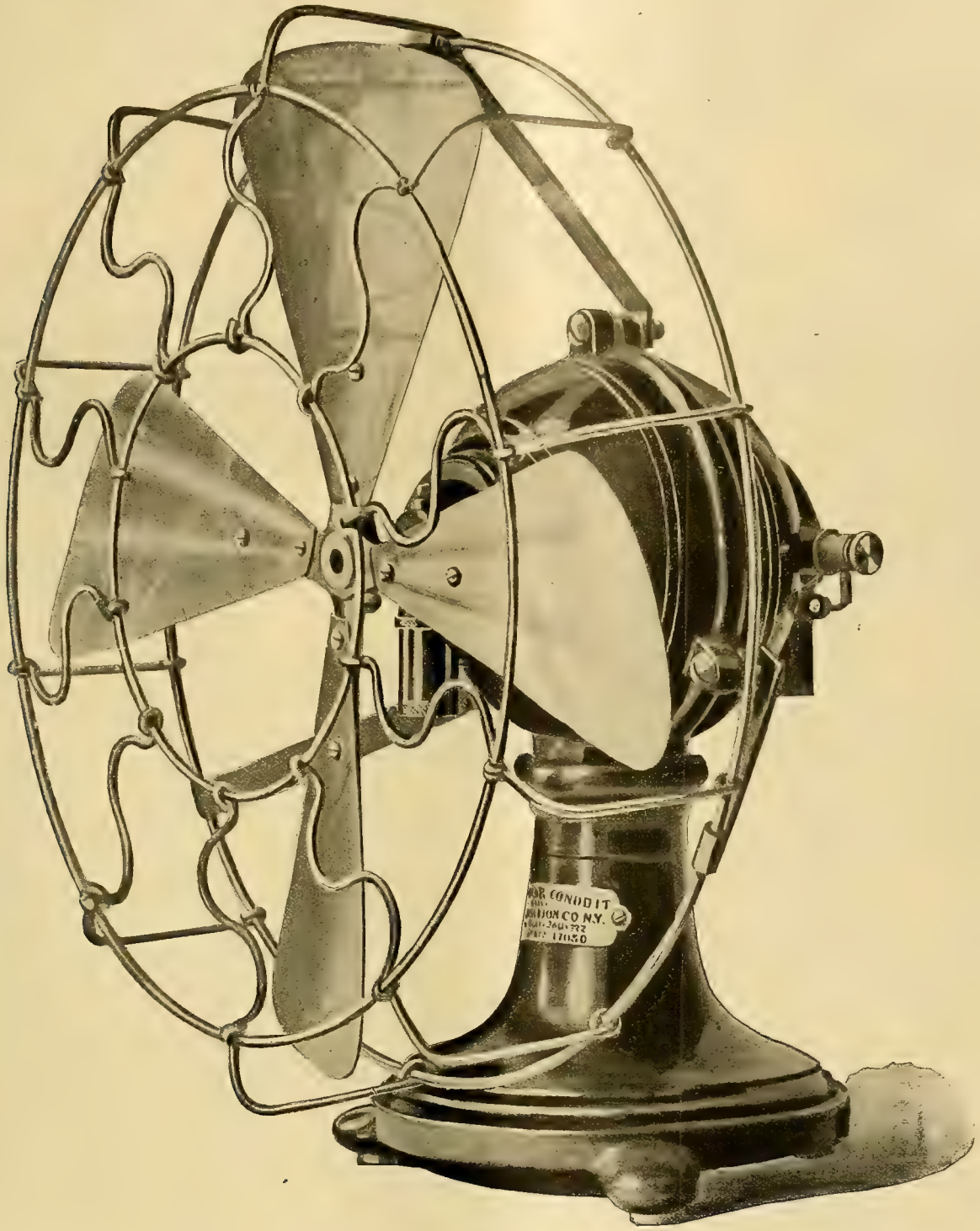

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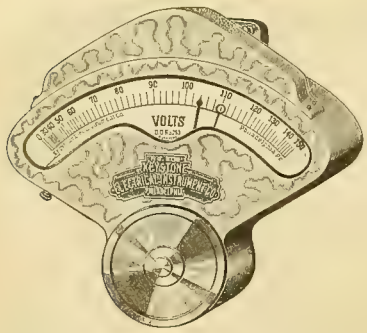

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Switchboard Voltmeters, Ammeters, Ground Detectors and Differential Voltmeters.

We meet all the requirements of modern Central Stations or Isolated Plants, whether using direct or alternating current circuits.

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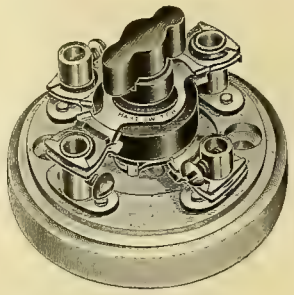
Caused by defective switches can be secured by making sure that the words **"HART SWITCH"** are stamped in the metal.



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HART 20 AMPERE DOUBLE POLE

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Our Illustrated Catalogue will be mailed on application.

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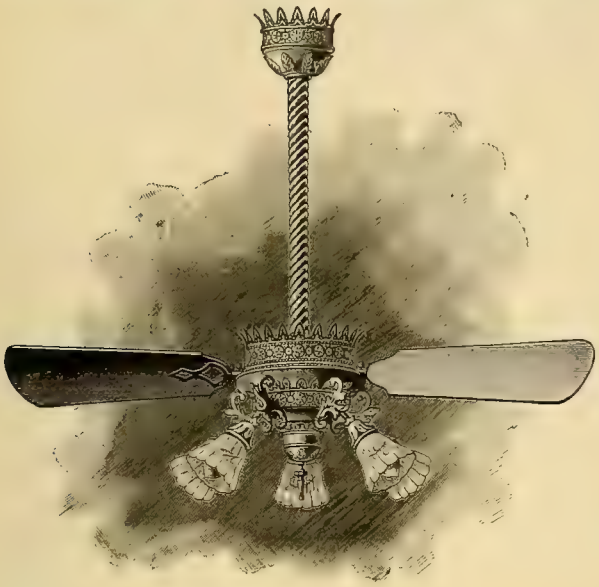

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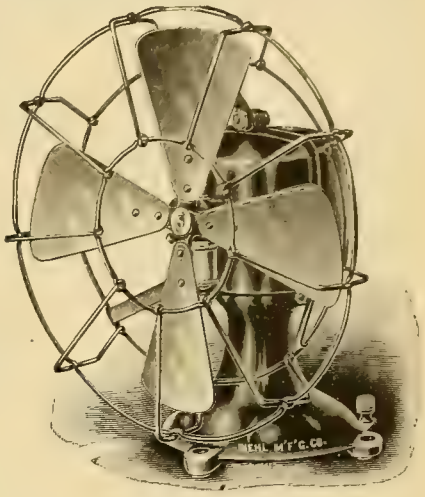

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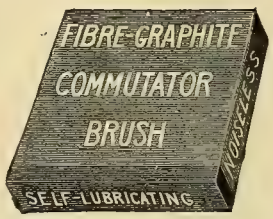

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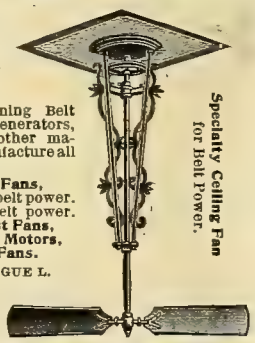

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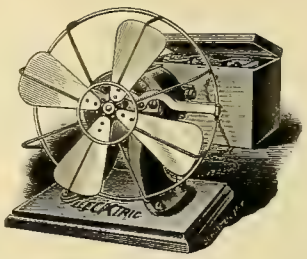

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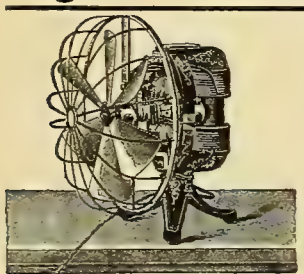

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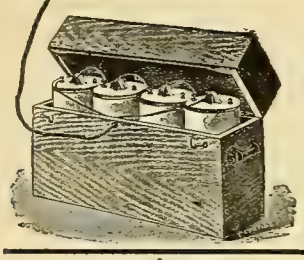

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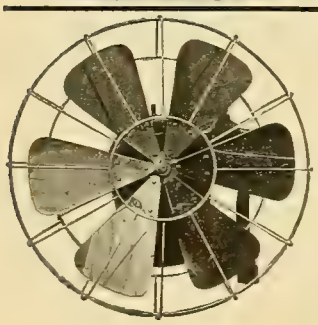

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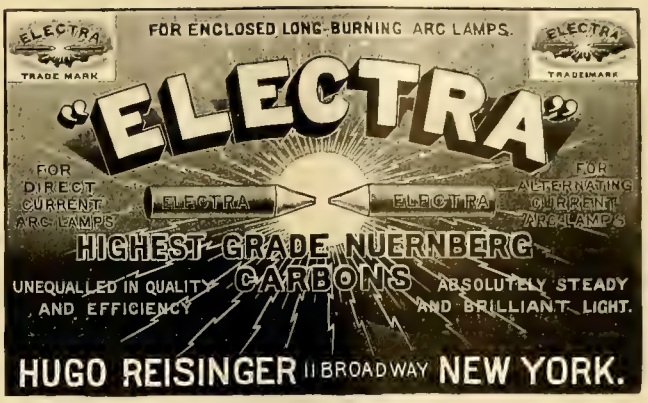

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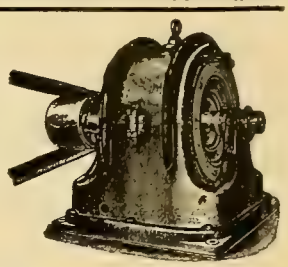

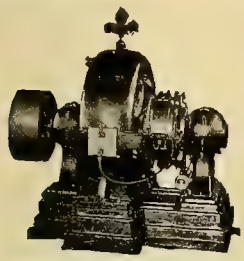

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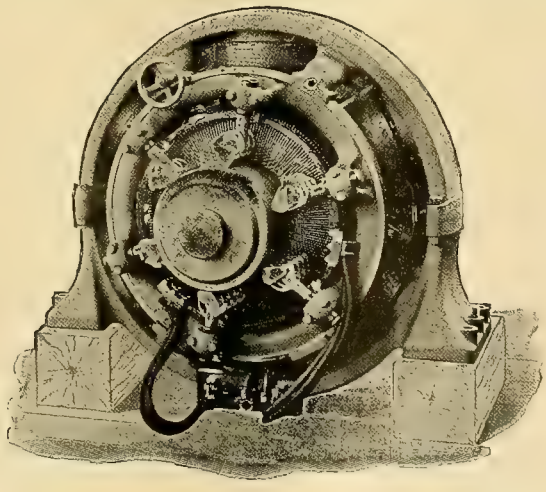

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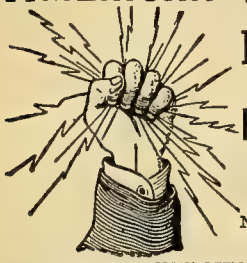

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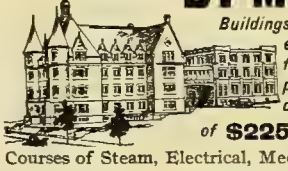

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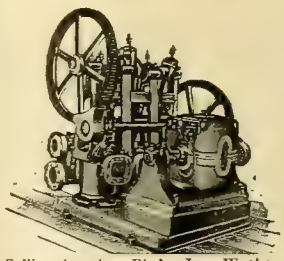

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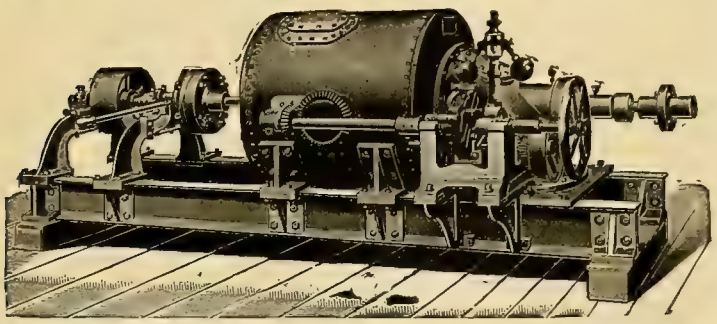

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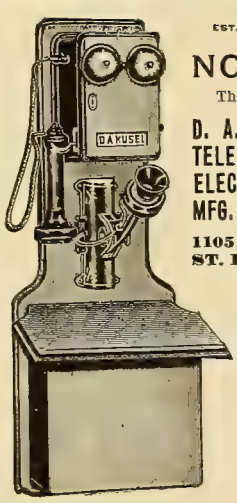

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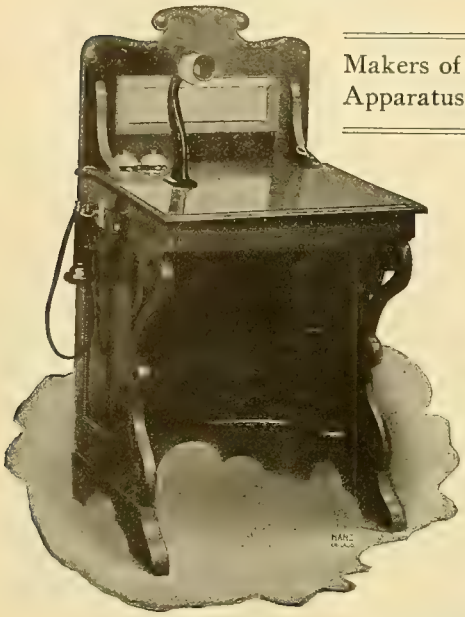

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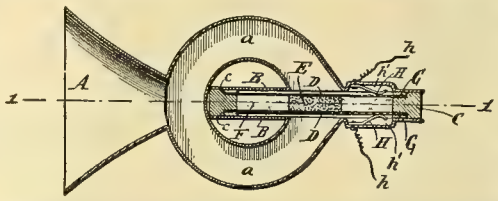

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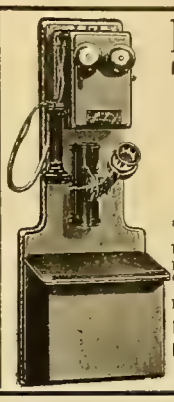

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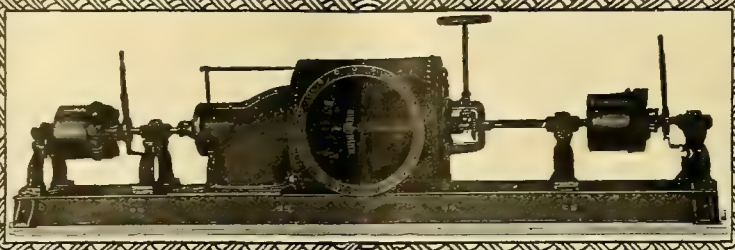

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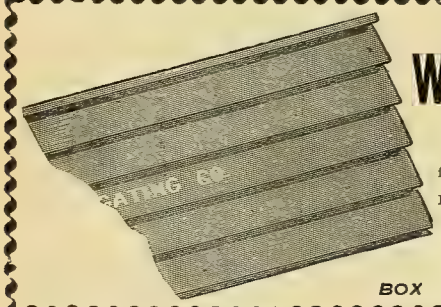

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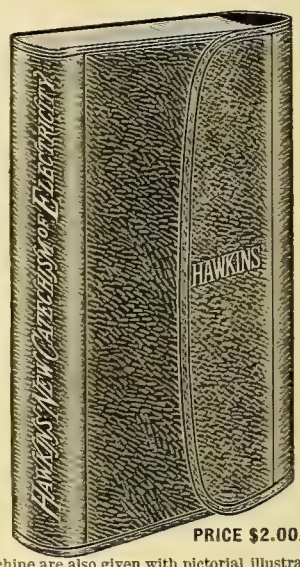

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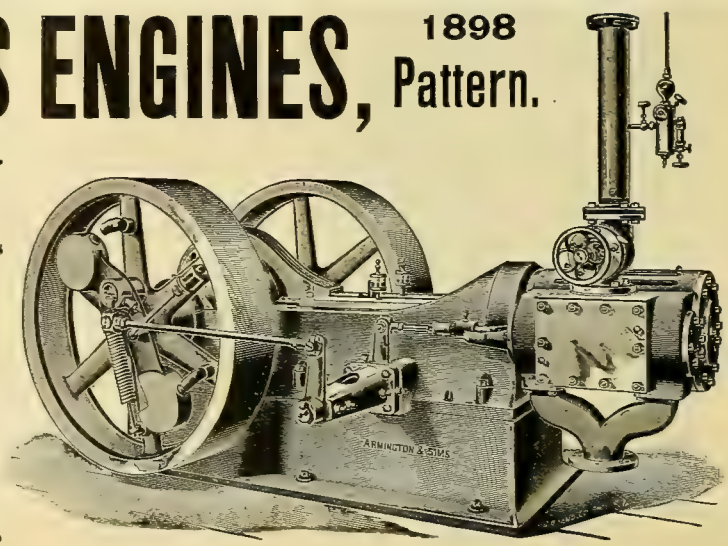

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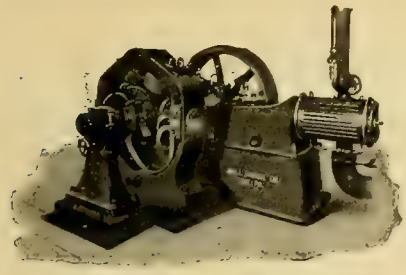

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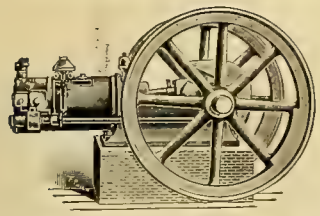

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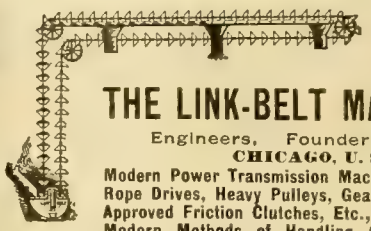

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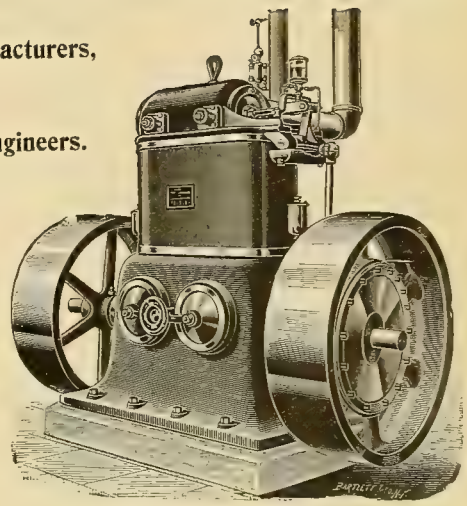

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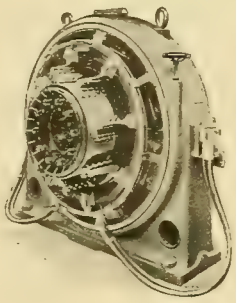
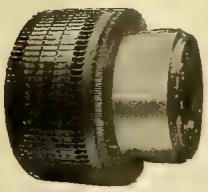
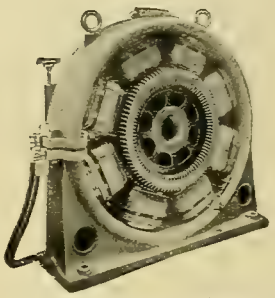


100 K. W. Westinghouse "Engine Type" Generator—Front View.



100 K. W. Westinghouse "Engine Type" Generator Armature.



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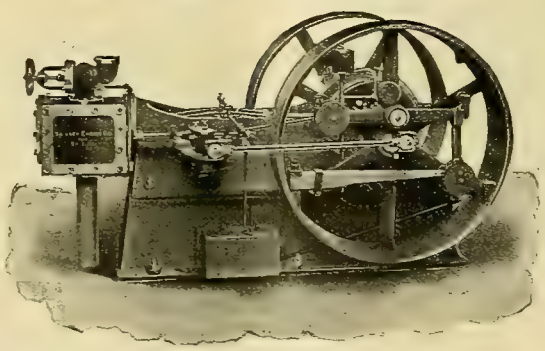

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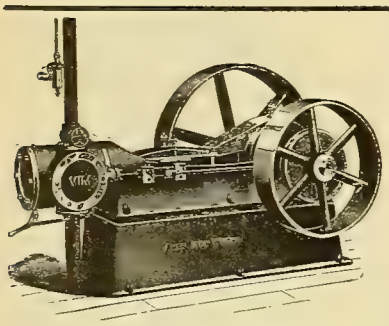

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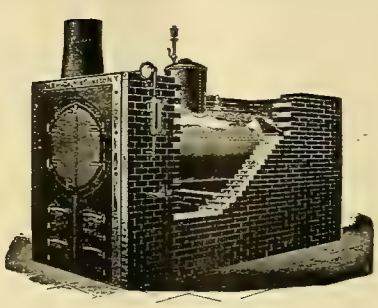

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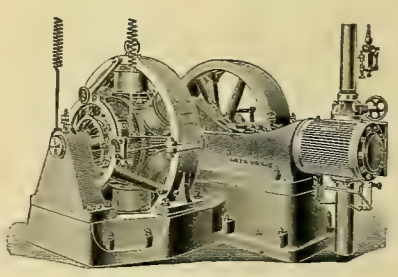

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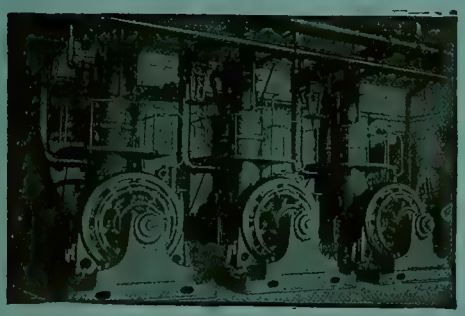

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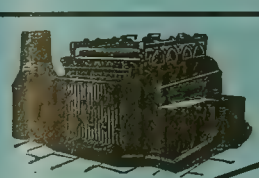

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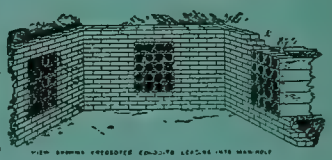

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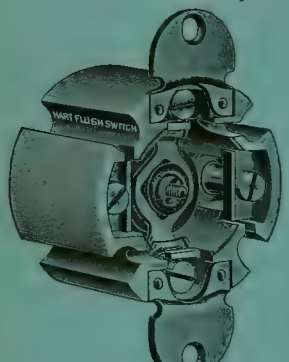

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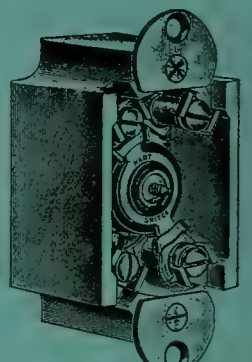

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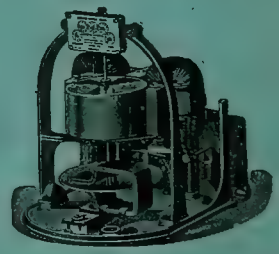

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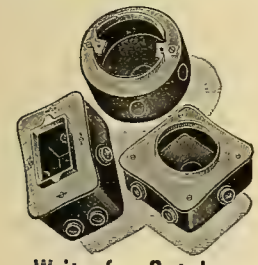

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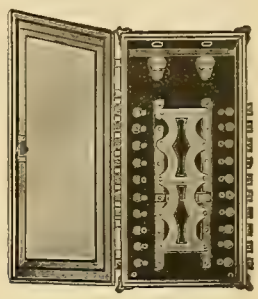

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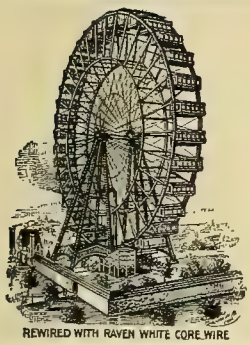

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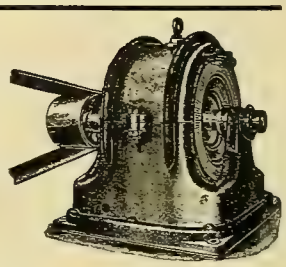

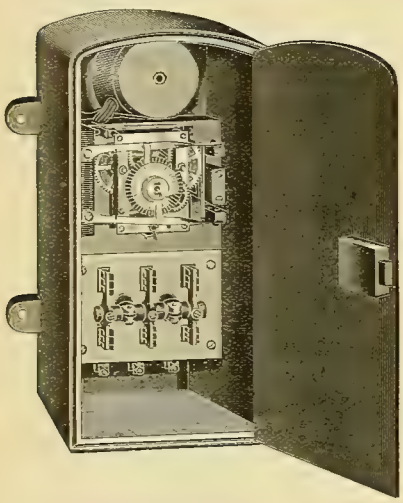

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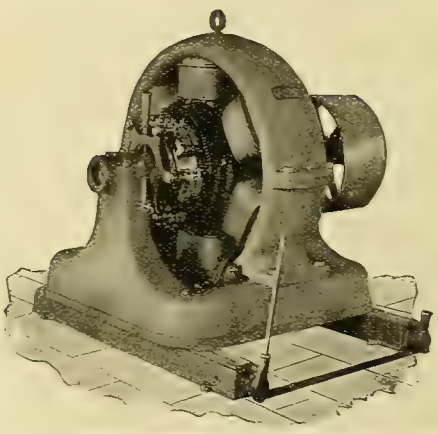

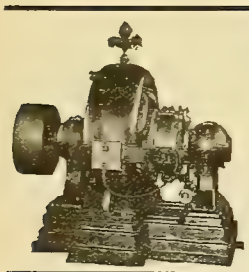

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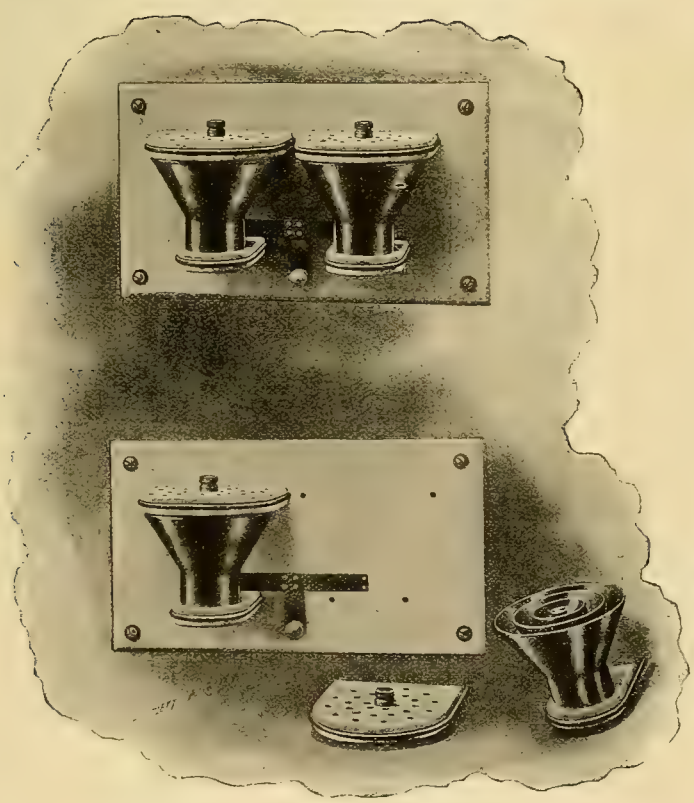

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Washburn & Moen Mfg. Co.

Junction Boxes.
Bossert Elec. Const. Co.
Leonard, H. Ward Elec. Co.

Lamps, Incandescent.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.,
Illinois Electric Co.
Lynn Incandescent Lp. Co.
Sawyer-Man Elec. Co.
United Elec. Imp. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Link-Belt Machinery Co.
Stilwell-Bierce Smith-Valle
Westinghouse, Church, Kerr & Co.

Mica.
Central Electric Co.
Commercial El. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.

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Akron Elec. Mfg. Co.
American Engine Co.
Belknap Motor Co.
Bullock Elec. Mfg. Co.
Card Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Illinois Electric Co.
Northern Electl. Mfg. Co.
Sargent & Lundy.
Stanley Elec. Mfg. Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Wray Co., John C.

Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

Paints.
Atlantic Alcatraz Asph. Co.
Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Standard Paint Co.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

Platinum.
Baker & Co.

Poles.
Berthold & Jennings.
Central Mfg. Co.
Electric Ry. Equipment Co.
Lindsley Bros.
Michigan Pipe Company.
Perrizo & Sons.
Torrey Cedar Co.
Valentine-Clark Co.

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Empire China Works.
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Cincinnati Corrugating Co.

Second-Hand Machin'y.
Corman Co.
Hine & Co., L. A.
Hodge, Walsh & Loring.

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Electric Appliance Co.
Illinois Electric Co.
Partrick, Carter & Wilkins.
Western Electric Co.

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Keystone El. Instrument Co.
Queen & Co.
Weston Electrical Inst. Co.

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American Battery Co.
Electric Storage Battery Co.
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Stephenson Co., John.

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American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.

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Cabinet Mfg. Co.
Commercial El. Supply Co
Ericsson Telephone Co.
Farr Tel. & Cons. Sup. Co.
Holtzer-Cabot Electric Co.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A., Tel. & El. Mfg. Co
Northwest Engineering Co
Rawson Electric Co.
St. Louis El. Supply Co.
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Sterling Electric Co
Stromberg-Carlson Tel. M. Co.
Viaduct Mfg. Co.
Western Electric Co.
Western Tel. Cons. Co.
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Klein & Son, Mathias.

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Diamond Elec. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
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Rose Polytechnic Inst.
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Besly & Co., Chas. H.
Brixey, W. R.
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Electric Appliance Co.
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Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Washburn & Moen Mfg. Co.
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Zincs.
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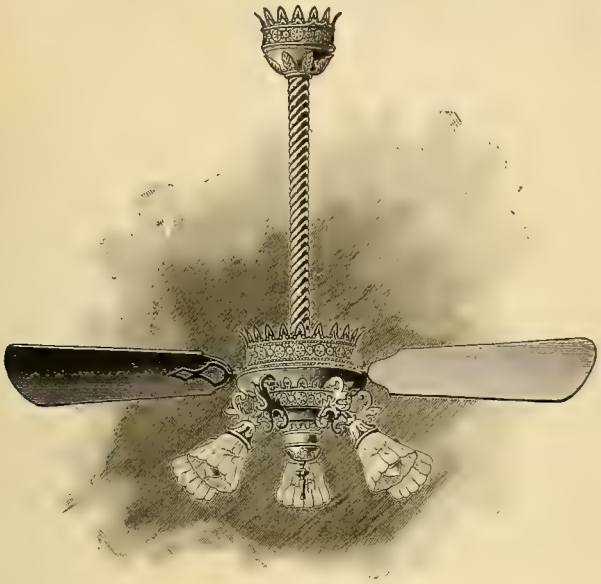
FOR ALL CIRCUITS, EXCEPT ALTERNATING.

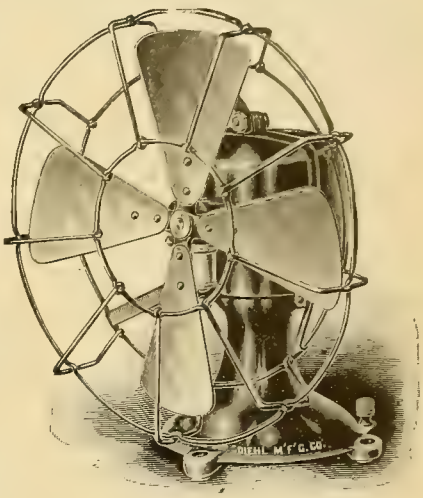


OUR CEILING FANS AND ELECTROLIERS
ARE THE

Recognized Standard
OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

Highest Efficiency
Of Any on the Market.



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ON

Ceiling Fans—Column Fans—Counter Column Fans—Desk Fans—Bracket Fans—Exhaust Fans.

Showrooms: NEW YORK: 561-563 Broadway.
CHICAGO: 192-194 Van Buren St.
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DIEHL MANUFACTURING CO.,
ELIZABETHPORT, N. J.

INCANDESCENT LAMPS 12 cents.

Now is the time to get your burned out lamps together and have them renewed or turned into cash. We have now repaired over 700,000 lamps, and nine out of ten of our shipments are to old customers.

We use the same care as regards voltage, candle power, etc., as in making our new lamps.

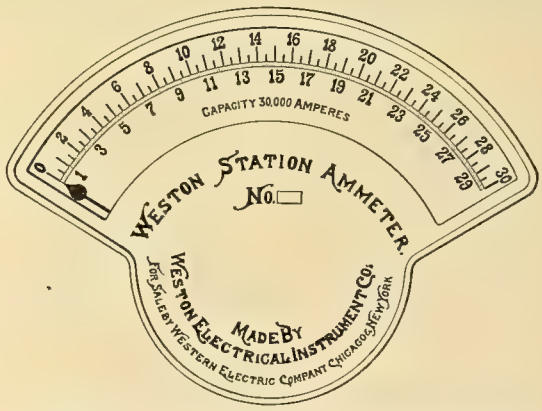
We are now pleasing central station managers by supplying a uniform and efficient lamp at a price that makes it profitable to replace lamps every 600 hours or oftener.

The renewal of lamps makes this possible.

If you prefer new lamps, we can supply you with the best and allow you three cents each for your burned out lamps.

Lynn Incandescent Lamp Co.,
LYNN, MASS.

THE LARGEST, NOTE THE SIZE.



The above is a reduced illustration of one of the largest electrical measuring instruments ever manufactured. The dimensions are given in inches, in the small table below:

Extreme width of instrument	39¾
Extreme height of instrument	29¼
Thickness from face of instrument to wall	7
Extreme length of scale	30
Ampere capacity	30,000

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FOR ELECTRICAL
TESTING, MEASURING AND
STATION INSTRUMENTS.

WESTERN ELECTRIC COMPANY,
CHICAGO. NEW YORK.

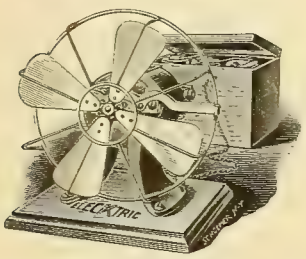
LAKON TRANSFORMERS. W. E. FAN MOTORS.

FAN

Commercial Electrical Supply Co.

1007-1009 MARKET ST. MOTORS ST. LOUIS

KEEP COOL



and buy our outfits. They are the best 6 inch, 8 inch and 10 inch Fans. 1898 models.

Run over

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GORDON CELLS.

THE ONLY WATER MOTOR which can be adjusted or tilted in any direction while running.
Patented June 28, 1898.

7 in. diameter 2¼ lb.; brass turned balance wheel and pulley. Price..... $13.60 SPOT CASH.
9 in. diameter, 2¼ lb.; brass turned balance wheel and pulley. Price..... 17.60 SPOT CASH.
7 in. diameter, with 12 in. polished brass fan and brass guard. Price..... 14.40 SPOT CASH.

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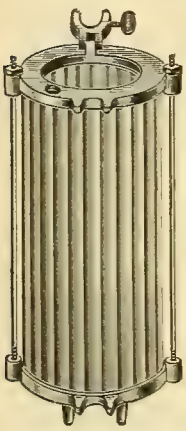
The S-W Arc Light Radiators.



BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.

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In our 21 years experience in bicycle building no innovation in cycle construction has ever given us so little trouble and riders so much satisfaction as

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Chainless Bicycles, $125.

They make hill climbing easy; make coasting delightful; make cycling a pleasure under all conditions.

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Not a detail has been overlooked that will add to their beauty, strength and durability.

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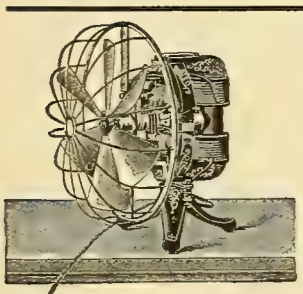

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The most economical and efficient battery fan motor on the market.

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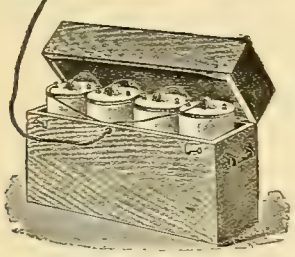

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THOS. A. EDISON, Proprietor.

FACTORY: ORANGE, N. J.

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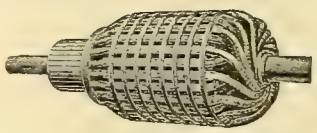

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Armature Winding for any System.

Chicago Armature Co.,
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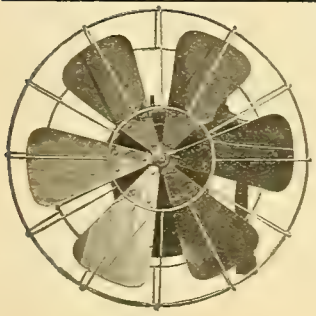

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Novel in Construction.
As Easily Installed as an Electric Fan Motor.
Simple, Economical, Effective, Noiseless.

Discounts for Exclusive Agents. Correspondence Solicited. List Price, $10.00.

JUST THE THING FOR SUPPLY HOUSES TO CARRY.

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McGILL & POMEROY, 321 Dearborn St., Chicago, Ill., Agents for Indiana, Illinois, Missouri, Iowa, Wisconsin, Michigan.

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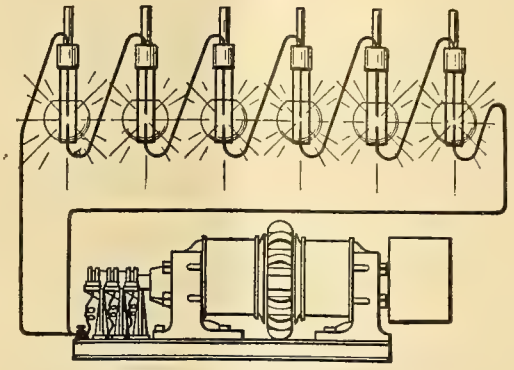
BRUSH

THE BRUSH ELECTRIC COMPANY

Brush apparatus has been on the market for twenty years. A majority of customers order supply parts direct from us. Many do not. We want this trade and are reducing our prices in order to secure it. Ask for quotations and send orders to the nearest Sales Office.



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Cleveland, Ohio.
Boston, Mass., 180 Summer Street.
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Philadelphia, Pa., 509 Arch Street.
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St. Louis, Mo., Wainwright Building.
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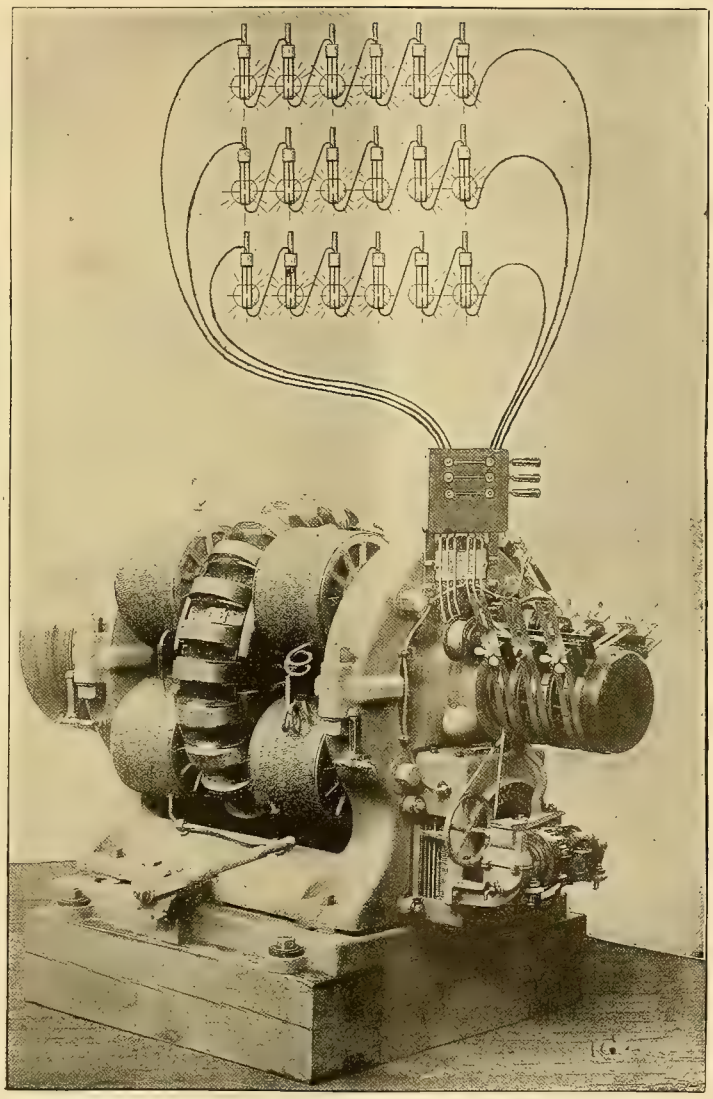
Denver, Colo., Kittredge Building
San Francisco, Cal., Claus Spreckels Building.
Toronto, Ont., Canadian Gen. Elec. Co., Ltd.
Pittsburg, Pa., 502 Tradesman's Bank Building.

Many stations have exchanged all their small units for large Brush arc dynamos. Among them in lights' capacity are:

Buffalo	4,250
Brooklyn-Citizens	3,360
Newark, N. J.	3,000
New Orleans	2,250
Cleveland	2,150
Philadelphia Brush	1,500
New York City	1,375
Philadelphia-Northern	1,300
Brooklyn-Municipal	1,200
Worcester	1,000
Washington, D. C.	1,000
Toronto	900
Harrisburg	750
Malden, Mass	720
Cambridge, Mass.	720
Norfolk, Va	720
City of Chicago	700
Boston, Mass	660
Quebec	625
Paterson	625
John Wanamaker	625
Brooklyn, Kings Co.	625
Rockford, Ill.	625
Erie	500
Albany	500
Troy	500
Carnegie Steel Co.	500
Manchester, N. H.	500
Reading, Pa.	500
Montgomery, Ala.	480



BRUSH MULTI-CIRCUIT 125-LIGHT ARC DYNAMO—1898.

Over 60,000 lights' capacity in large Brush arc dynamos sold. A large proportion of them using Multi-Circuit Dynamos.

The newly designed Brush dynamos have the following capacities: 55, 80, 100, 125, 240, 300, 2,000 candle power lights; 45, 85, 120, 160, 1,200 candle power lights.

Brush arc lamps were first used in 1877. More of them being sold to-day than ever before.

Two or more separate circuits run direct from one dynamo with any distribution of load on the different circuits.

The advantages are absolute flexibility in handling of circuits; reduction of high voltages on circuits run from large dynamos; use of large units with corresponding increase of efficiency; saving in floor space, oil, belts, shafting, pulleys, attendance.

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SHANGHAI MUNICIPAL COUNCIL,
ELECTRICAL DEPARTMENT.

EXTENSION OF PLANT.

THE COUNCIL hereby invites tenders for the supply of the following plant, viz:—

A.—Two 100-kilowatt Alternators, direct coupled to horizontal medium speed Engines.
B.—Switchboard and Instruments.
C.—Water-tube Boiler.

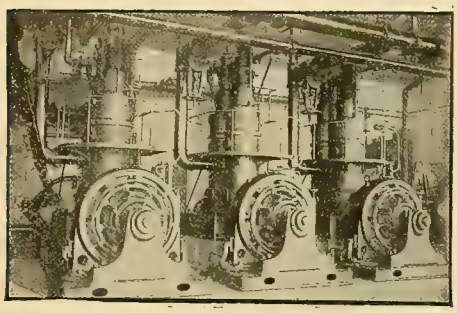
The general conditions and specifications for the plant required may be had or examined upon application to MR. F. S. BLACKALL, of the firm of BLACKALL & BALDWIN, 39 Cortlandt Street, the Council's Agent in New York, to whom sealed tenders should be sent not later than 12 o'clock noon, on Wednesday, 10th August, 1898, bids to be marked "Tender for Shanghai Electric Light Plant." All quotations must include package and delivery, f. o. b. N. Y.

The Council does not bind itself to accept the lowest or any tender.

By order,

J. P. BLAND,
Secretary.

Council Room—SHANGHAI, CHINA,
May 31st, 1898.



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Engines Especially Designed for This Service. Dynamos Especially Designed for These Engines.

CENTRAL VALVE ENGINES.

Compound or Triple Expansion. Condensing or Non-Condensing.

GIVE MAXIMUM ECONOMY.

Over 215,000 H. P. in Use and on Order. Lowest Cost Per K. W. Hour. Highest Efficiency. Combined Sets Occupy Smallest Possible Floor Space.

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This handbook is a complete treatise on telephony, and a practical book on telephone working and management, based entirely on standard American practice. It is extremely useful to telephone inspectors and operators.

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This little volume is an extremely practical work for telephone employes, written in a popular style and devoid of technicalities.

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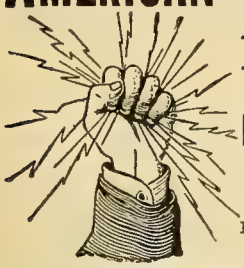
PROVIDENCE, R. I.



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Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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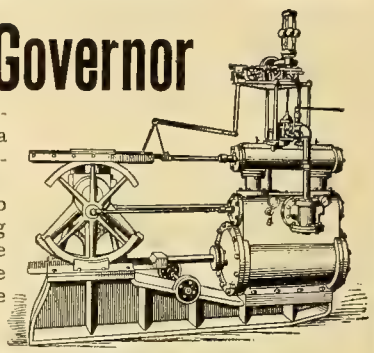
Regulates the turbines used on electric railway load in the Niagara Falls Hydraulic Power & Manufacturing Company's plant.

We build governors adapted to all makes of water-wheels, working under all conditions. 70,000 horse power in use. We guarantee the best speed regulation which can be obtained under any conditions.



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CONTRACTING AND MANUFACTURING
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Contractors for Power and Lighting Plants. Manufacturers of Electrical Specialties, and Special Apparatus for any purpose whatever.

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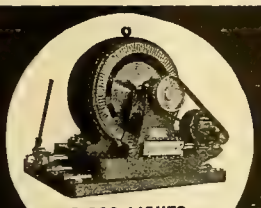

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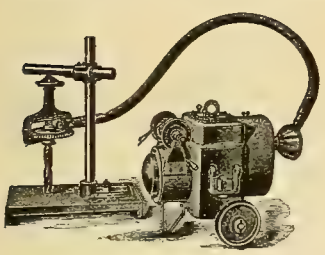

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The contractor to whom this work may be awarded will be required to furnish a bond in a sum equal to one-half the amount of the contract, with sureties acceptable to said Park Commissioners.

No proposal will be considered unless the party submitting it shall furnish evidence satisfactory to the West Chicago Park Commissioners of his or their ability and that he or they have the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract.

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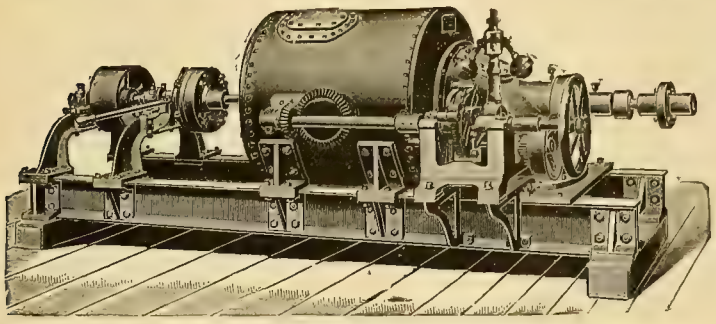

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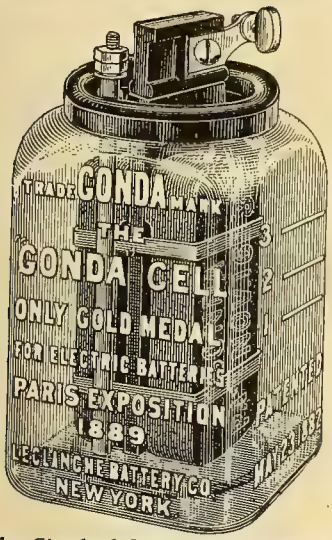

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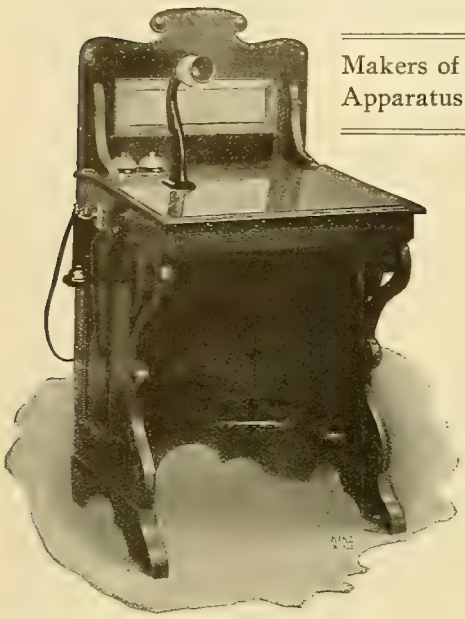

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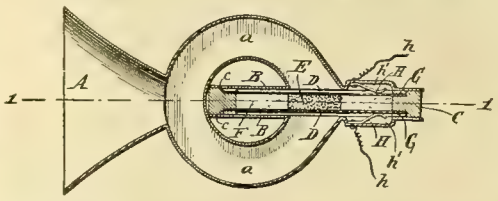

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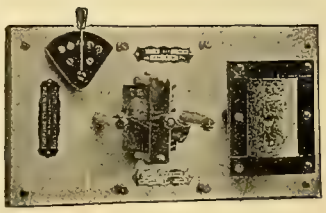

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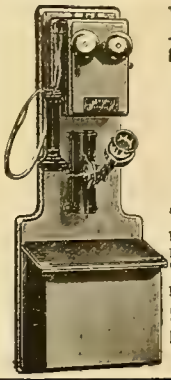

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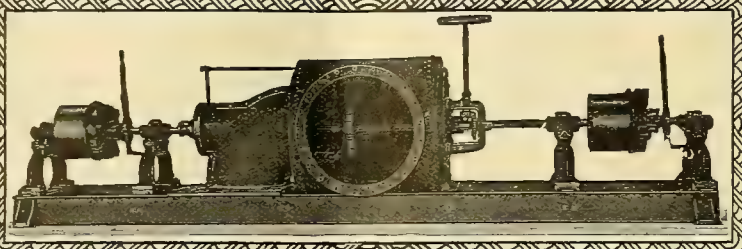

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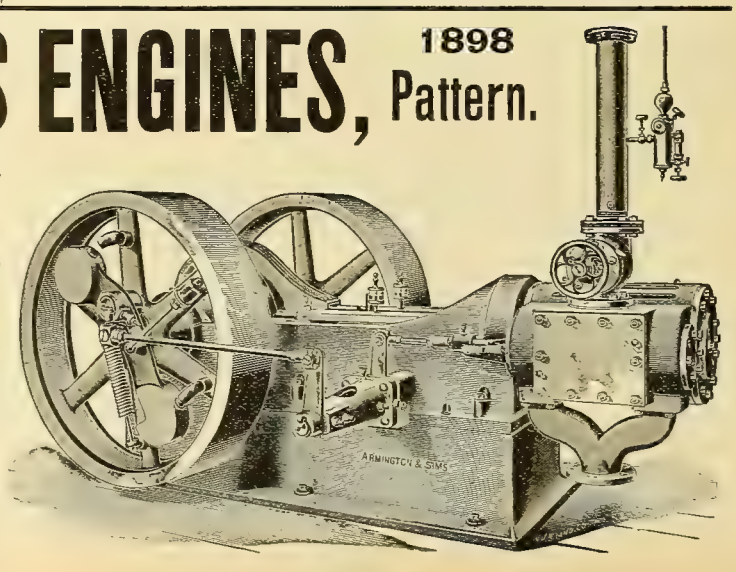

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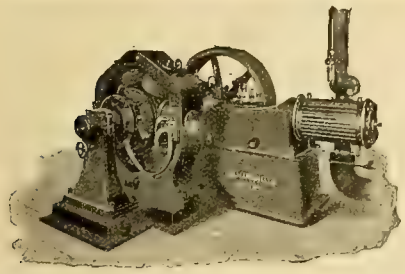

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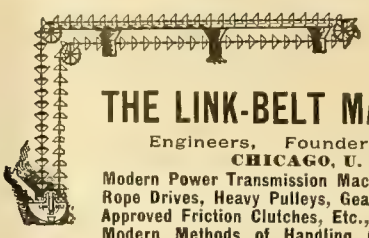

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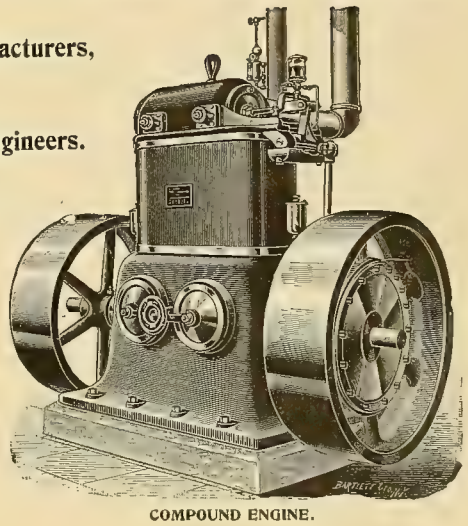

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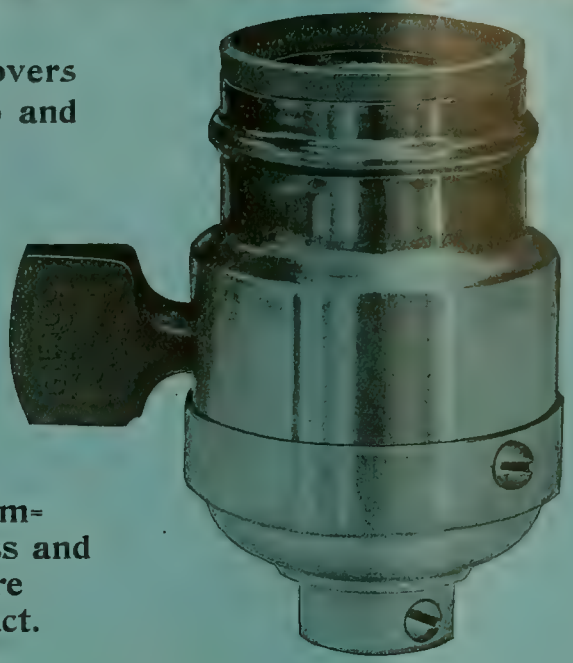

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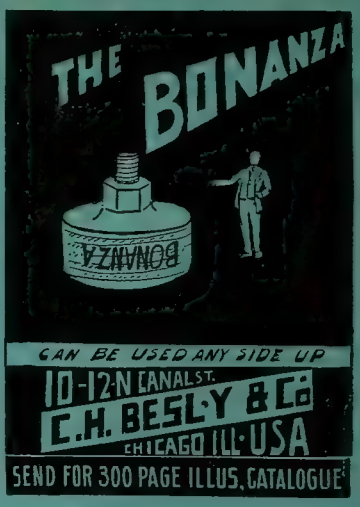

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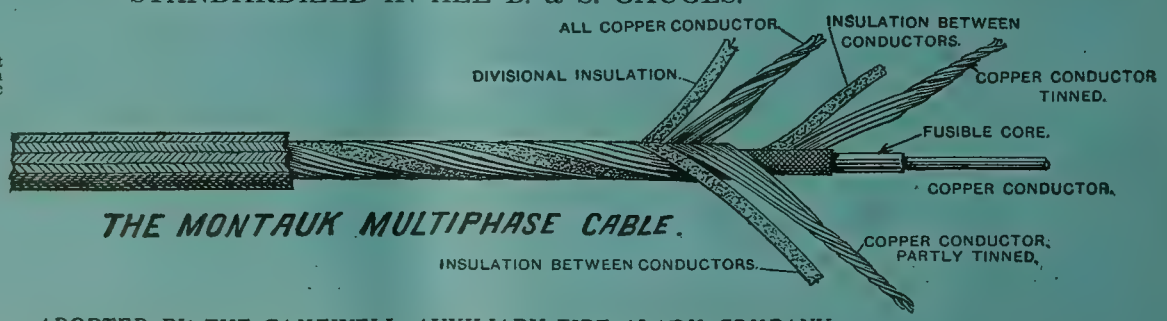

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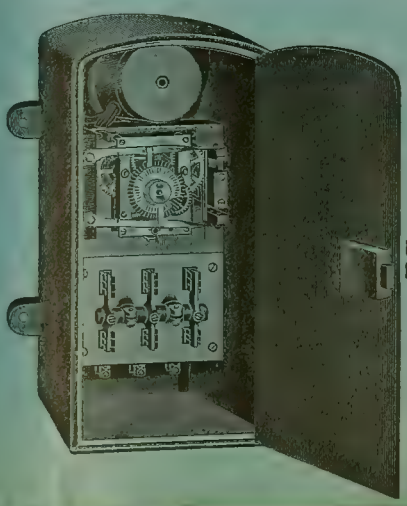

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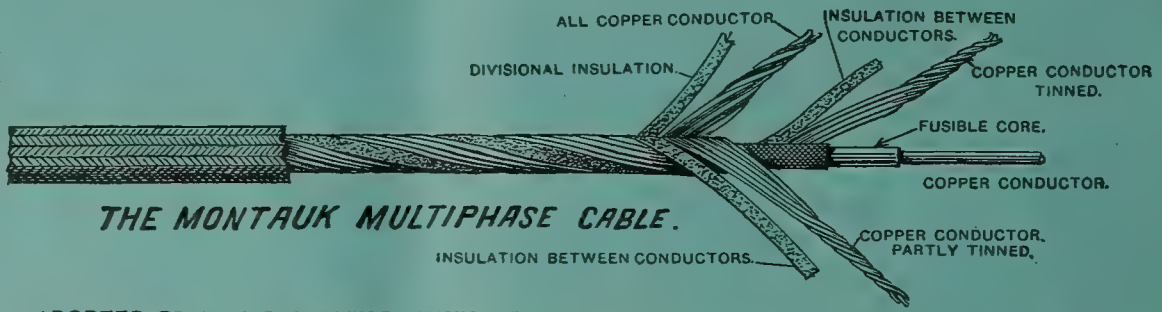

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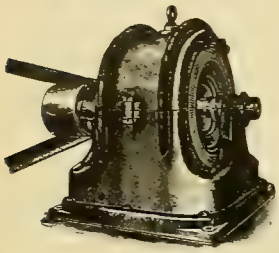

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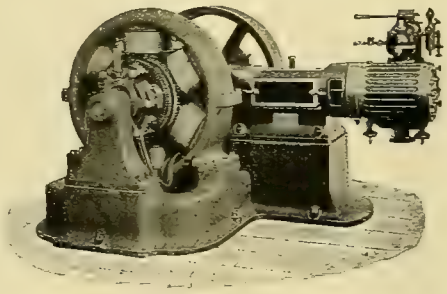

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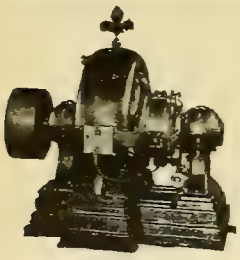

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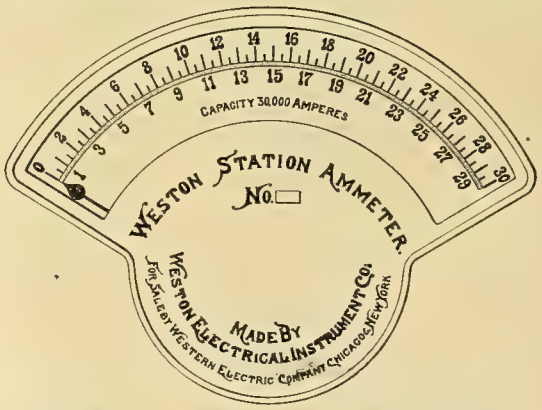

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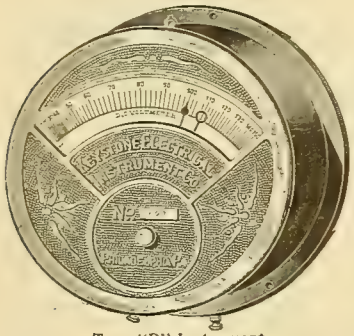

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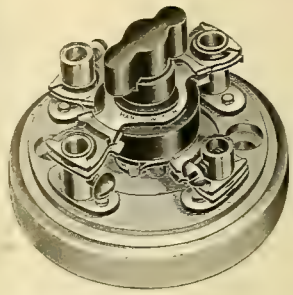

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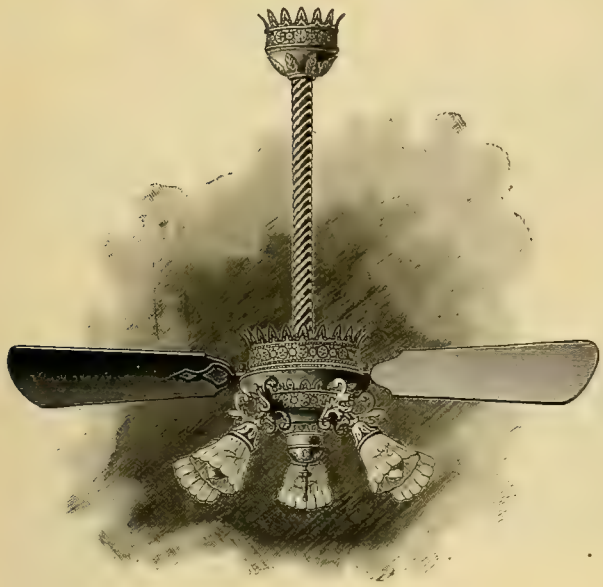

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OF THE WORLD.

Our Desk and Bracket Fans are Built of the Finest Material and are the

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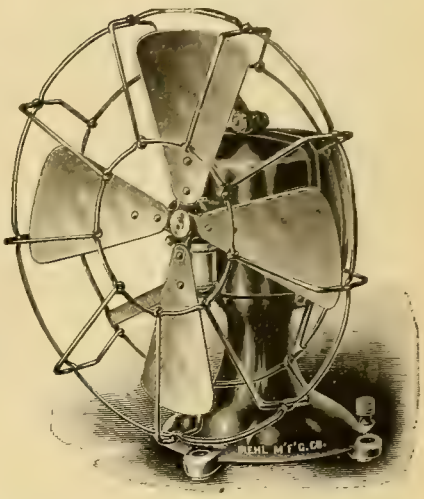
Of Any on the Market.



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This meter is calibrated ready for instant use.
This meter requires no knowledge of electricity to erect.
This meter shows the load passing every instant.
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This meter has no springs, jewels, frictional errors or lag.
This meter once right is always right.

THEY STILL USE IT.

Stover Bicycle Manufacturing Co.

IT COSTS SO LITTLE AND WORKS SO WELL

FREEPORT, ILL., March 2nd, 1897.

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STOVER BICYCLE MFG. CO.
W. A. Hance, Supt.

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The Best System of Belting in the World

The D&D Transmitter
MONTPELIER, VT.

Compared with Straight Belts - - { Easier on bearings, Smaller per cent. of slip, One-half the space.

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Compared with Direct Coupling - { About the same floor space, Cost much smaller, Easier to keep in repair.

Write for Further Particulars.

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Arc Light Radiators

BRILLIANT AND ECONOMICAL.

Absolutely free from **side shadows,** or those cast by flying insects.

Diffuses light uniformly.

Easily attached and detached.

Can be cleaned without removal and are practically indestructible.

Made for all styles of arc lamps.

Send for descriptive circular and prices.

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Over a Mile Faster in the Hour.

Over 10% Advantage in Hill Climbing.

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It is generally admitted by those who have ridden them that Columbia Bevel-Gear Chainless bicycles are over a mile faster in the hour on ordinary roads than chain driven machines, and that they have 10% advantage in hill climbing.

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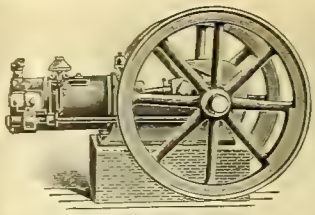

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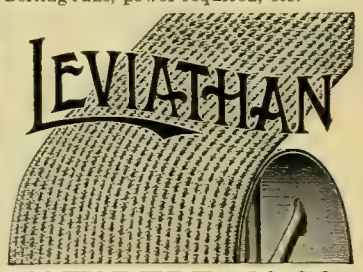

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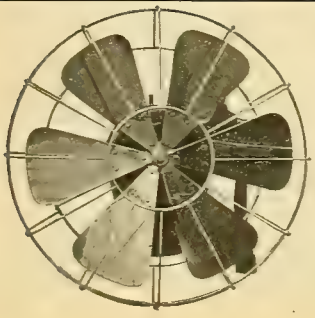

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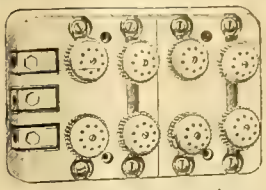

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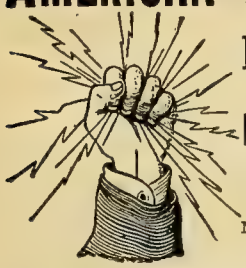

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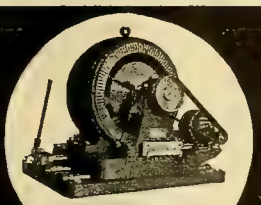

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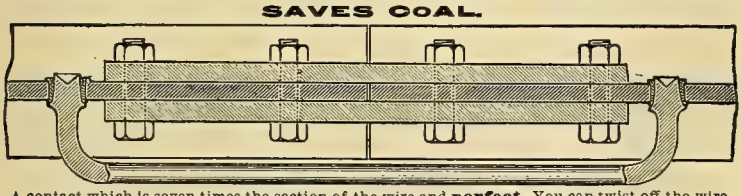

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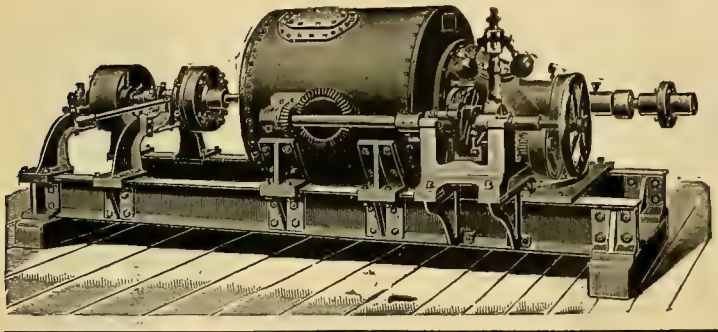

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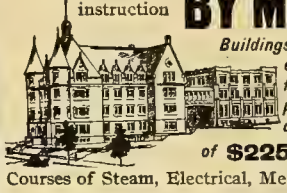

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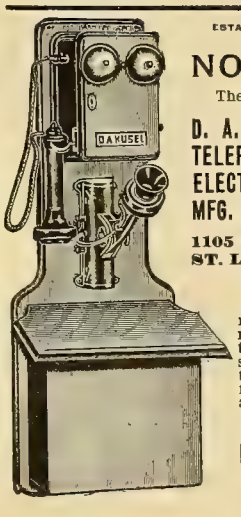

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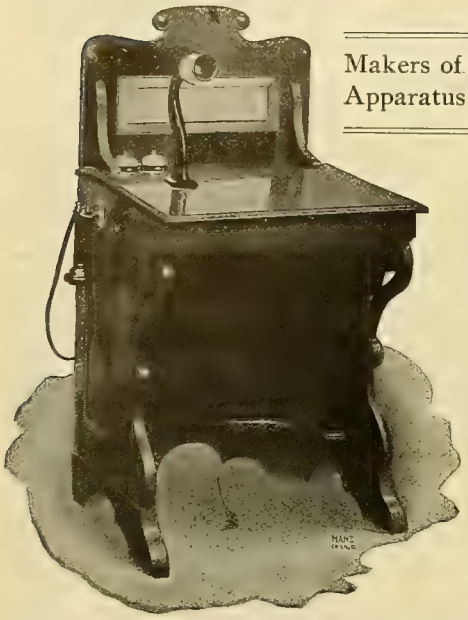

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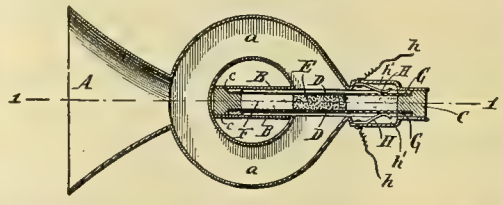

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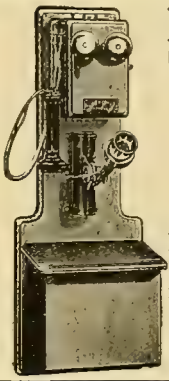

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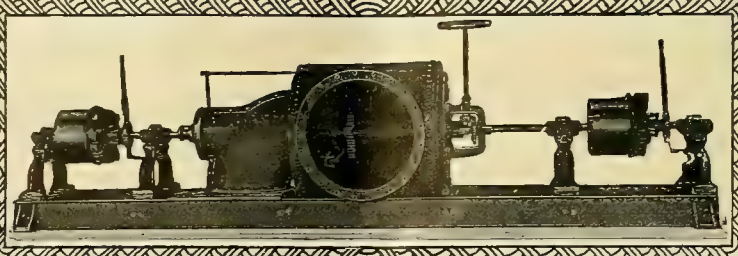

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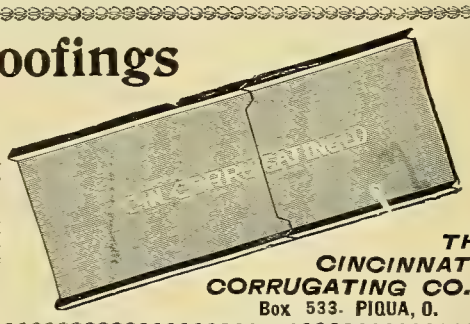

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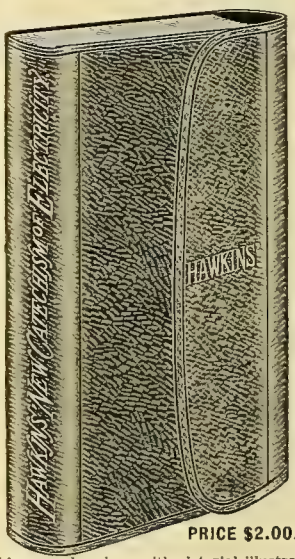

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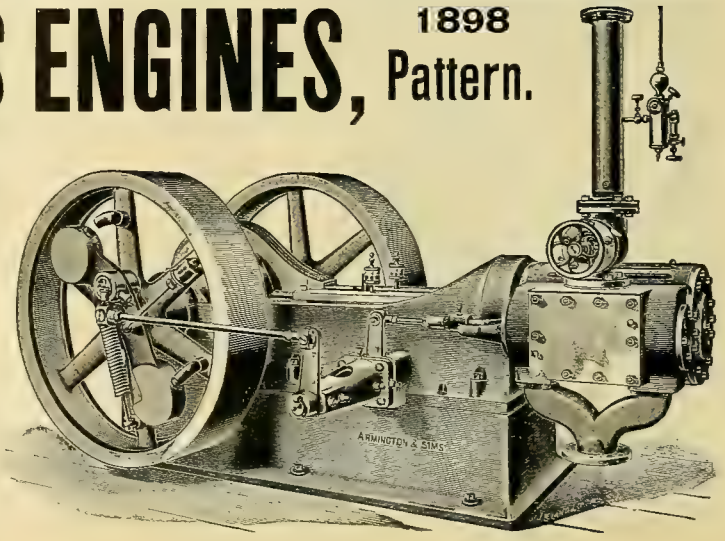

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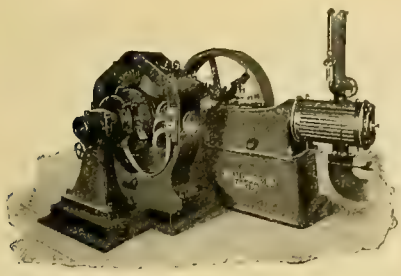

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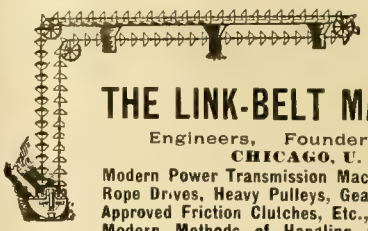

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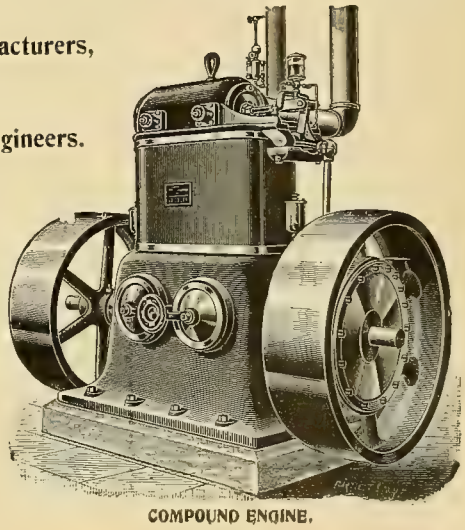

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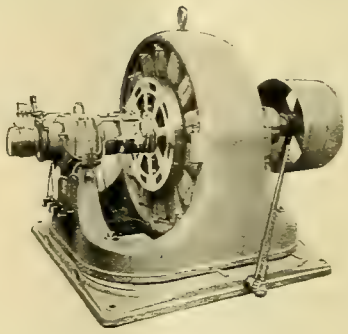

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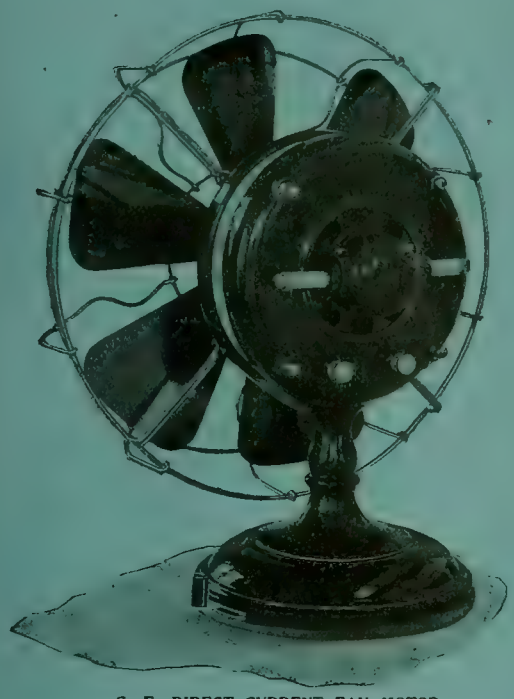

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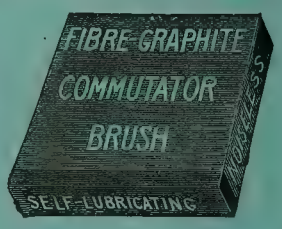

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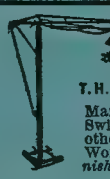

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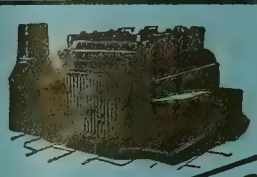

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For Steam Boilers. SAVES 10% TO 20% IN FUEL.

SOLE MAKERS IN THE U. S. A.

THE **Fuel Economizer Co.,**

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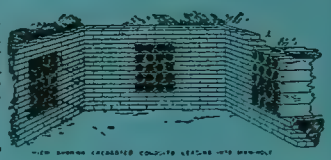
CREOSOTED WILL LAST FOR MANY YEARS.
IT PAYS TO USE THEM.
—GET OUR PRICES.—

CREOSOTED WOOD CONDUITS

FOR UNDERGROUND WIRES.

FOR TELEPHONE, TELEGRAPH AND ELECTRIC LIGHT COMPANIES.

There are advantages in using CREOSOTED WOOD CONDUITS not obtained in using any other kind; ...les will not be scratched by being drawn through them: no concrete foundation, sides or top required: wires in creosoted wood conduits are most easily reached between manholes: subways constructed with creosoted wood conduits in less time than by any other. In parks and on boulevards they are the best because vegetable growth is prevented, keeping roots away from cables.



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A National Rider never changes his mount—National Cycle Mfg. Co., Bay City, Mich. Get our New Catalogue.

W. S. HILL ELECTRIC CO., New Bedford, Mass.

Send for Catalogue.

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Central Electric Co., Chicago.

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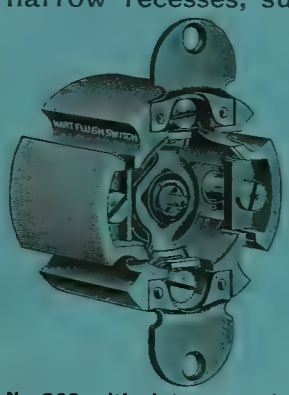
SWITCHES AND PANEL BOARDS.

HART FLUSH SWITCHES.

BEST and CHEAPEST.

As here illustrated, we make Flush Switches with both Round and Rectangular Bases. Our ROUND style Base will fit our regular Iron Frames and Boxes. Our RECTANGULAR Bases are adapted for narrow recesses, such as Frames and Boxes usually used for "Push Button" Flush Switches. You will therefore note that if some other style of Flush Switch which you have in use causes trouble, you can replace it with a



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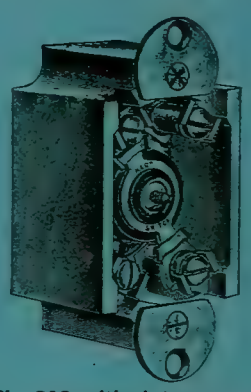
HART FLUSH SWITCH

without disturbing your own frame or box. Simply take out the defective Switch and replace it with a HART.

For full particulars, see our Illustrated Catalogue, pages 14 and 28.

All Electrical Supply Houses carry these Switches in stock, and can fill orders without delay.



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Make your orders read "HART" Switches, and you will be well satisfied with value received.

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TRANSFORMERS-WATTMETERS.

(SCHEEFFER'S IMPROVED.)

Double Primary Coils,
Double Secondary Coils,
Good Ventilation,
Light Weight,
High Efficiency,
Good Regulation,
Small Iron Loss,
Convenient to Install.

No Brushes,
No Commutator,
No Moving Wire,
Simplicity,
Durability,
Reliability,
Accuracy,
Even to a 6 c. p. Light.

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MANUFACTURERS,

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TRADE MARK:
"Chloride Accumulator"
REGISTERED SEPTEMBER 11, 1894.

CHLORIDE ACCUMULATORS FOR TROLLEY REGULATION IN THE STATION OF THE EASTON, PA., EDISON CO.

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DEAR SIR:—As per terms of agreement made at the time you sold us the battery, we were to decide at the end of the first year as to future depreciation. We desire to say that after a year's use we are so well pleased with its condition that we have decided to carry the depreciation ourselves.

The results obtained from the use of the battery have been in every way satisfactory and fully meets the claims made by you at the time of the installation. Our only regret is that it is not larger in size.

Yours respectfully,

HOWARD RINEK, General Manager.

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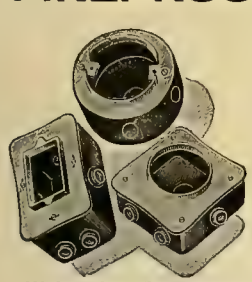
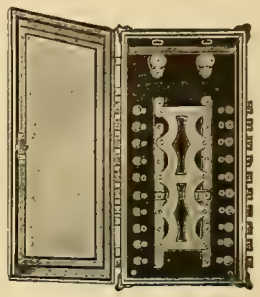


STEEL = Distribution and Main Junction.

OUTLET, SWITCH and CUTOUT. = BOXES



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Sole Mfr's. and Patentees. UTICA, N. Y.

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CHICAGO, April 30, 1896.

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As you are aware, the wire upon the wheel is very much exposed and the test will no doubt be a most severe one.

Yours very truly,
THE FERRIS WHEEL CO.
By L. V. Rice, Mgr.

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

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One Type A 18 T. H. Alternator, 260-light, compound wound, self-oiling	$400.00
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1—750-light Westinghouse Alternator, with exciter and instruments	425.00
1—1,000-light Westinghouse Alternator, with exciter and instruments	650.00
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1—A 60 T. H. 1,000-light Alternator	675.00
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1—15-light Sperry Arc Dynamo, 2,000 C. P.	100.00
1—25-light Sperry Arc Dynamo, 2,000 C.P.	140.00
1—35-light T. H. Arc Dynamo, 2,000 C. P.	300.00
1—45-light T. H. Arc Dynamo, 1,200 C. P.	300.00
1—50-light T. H. Arc Dynamo, 1,200 C. P.	400.00
1—50-light Standard Arc Dynamo, 2,000 C. P.	350.00
1—50-light Ball Arc Dynamo, 800 C. P.	200.00
1—125-light Sprague, 110-volt Dynamo (New)	140.00
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2—150 K. W. Westinghouse 4 Pole, New 500-volt.	$1,200.00

NEW T. H. RECORDING WATTMETERS, FOR ALTERNATING CURRENT, 50-VOLT.

10 Ampere	$8.50
20 Ampere	10.00
30 Ampere	12.00
50 Ampere	14.00

Also a large quantity of Shallenberger ampere-hour meters at remarkably low prices.

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Western Electric, single or double carbon	$7.50 each
Standard	6.00 each
T. H., 6.8 ampere and 9.6 ampere, single or double	10.00 each

The above Apparatus in Chicago stock ready for immediate delivery. Send for complete List of Electrical Machinery and Supplies.

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A GOOD BOOK!!

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50, 110, 220 VOLTS OF ANY C. P. MOUNTED IN STANDARD BASES.

We offer our lamps in competition with any others on the market. The HIGHEST DEVELOPMENT in life, maintenance of candle power, commercial efficiency and good workmanship ARE WHAT WE HAVE TO OFFER.

We make no claim to wonderful inventions revolutionizing the art, or to the employment of all the lamp experts available.

Series Lamps for any service or socket. Responsible representatives wanted in large cities.

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There's no chance for an argument.

We have without question the largest and best assorted stock of Electrical House Goods in the West.

OUR STOCK IS LARGE OUR PRICES ARE RIGHT

...and...

WE SHIP QUICK.

SPECIAL PRICES ON 16-INCH BRACKET FAN MOTORS.

CENTRAL ELECTRIC COMPANY,

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OKONITE — IT NEVER DISAPPOINTS

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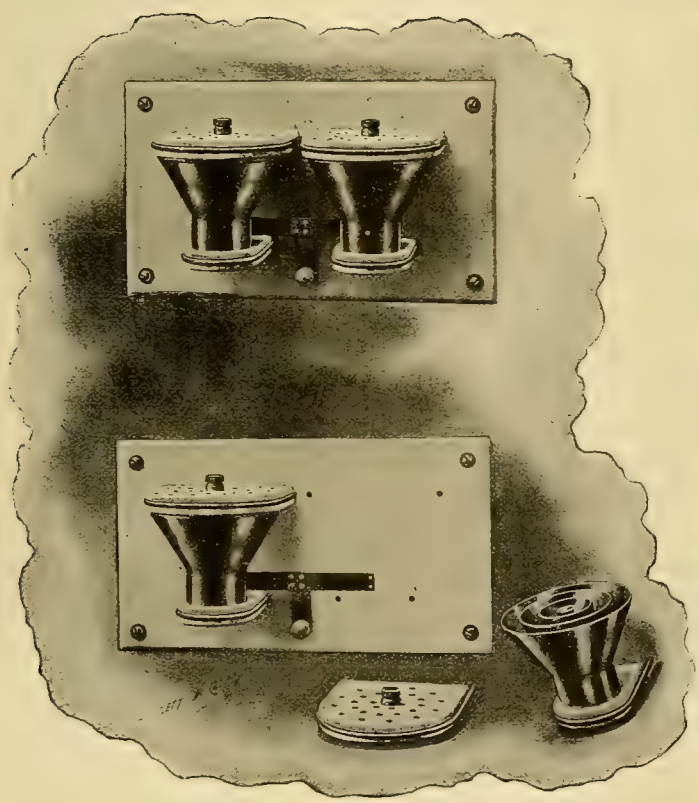
.... CHICAGO.



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In it the defects of the principal lightning arresters on the market are overcome. The E. M. F. required for discharges is less than is dangerous to the insulation of the system. The insulation of the arrester itself is very high. Liability to short circuits is avoided. Arc is quickly broken without excessive flow of dynamo current. Construction is strong and durable, and formation of arcs through accumulation of dirt, dust, bugs, etc., is impossible. Our choke coils add no self induction to the lines so far as dynamo current is concerned.

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THE ROYAL ELECTRIC CO., Montreal, Canada, are sole licensees for the manufacture and sale of the S. K. C. System in Canada.

BRANCH OFFICES: Chicago, 1506 Marquette Building.
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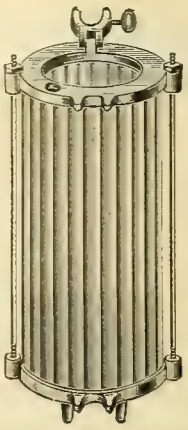
New York, Rooms 1006-1007 Empire Bldg., Broadway and Rector St.
San Francisco, 300 California Street.
Anderson, S. C.
St. Louis, Mo., Western Electrical Supply Co.

The S-W Arc Light Radiators.



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Diffuses light uniformly.
Easily attached and detached.
Can be cleaned without removal and are practically indestructible.
Made for all styles of arc lamps.
Send for descriptive circular and prices.

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FARIBAULT, MINN.

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Partrick, Carter & Wilkins.

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Washburn & Moen Mfg. Co.

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Commutator Co, The.

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Sargent & Lundy.
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Walker Company.
Western Electric Co.

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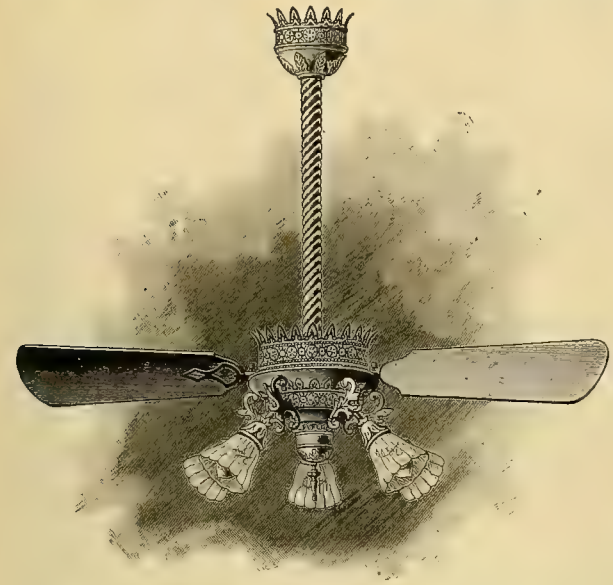

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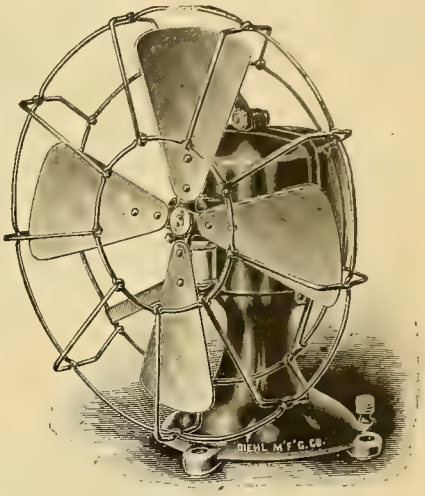

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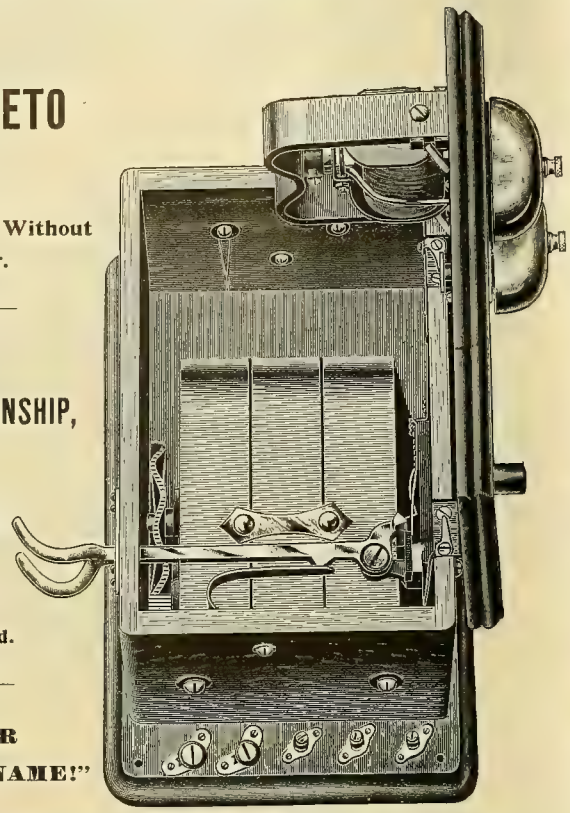

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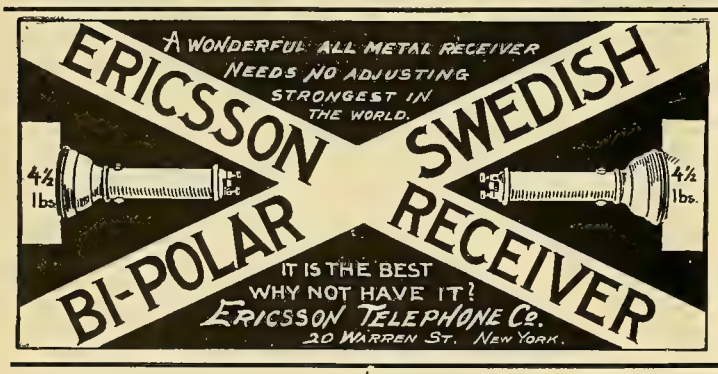

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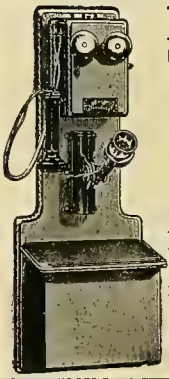

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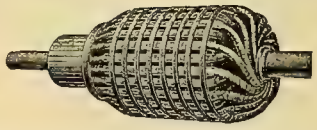

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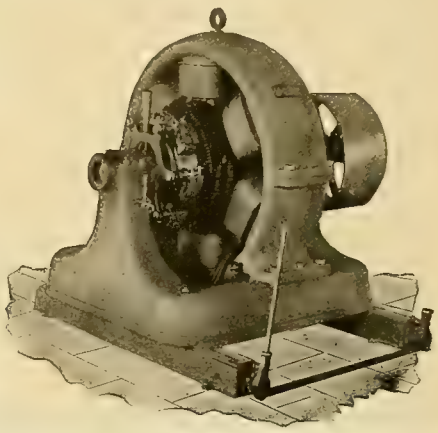

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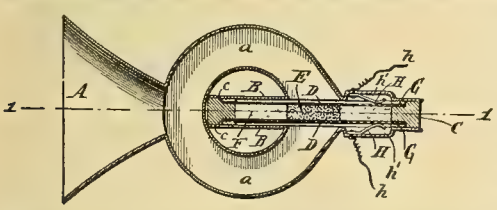

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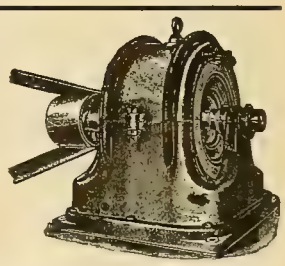

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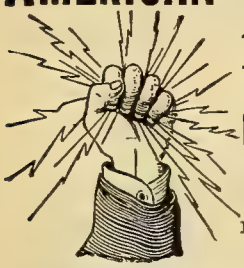

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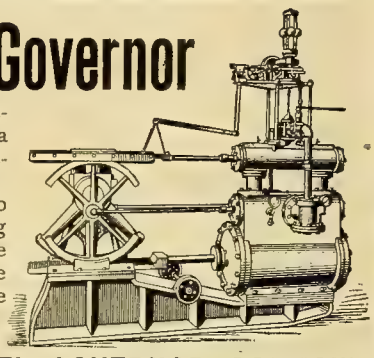

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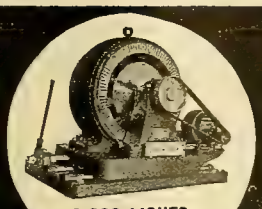

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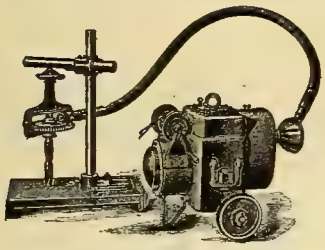

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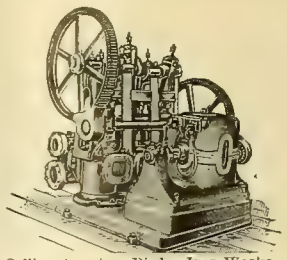

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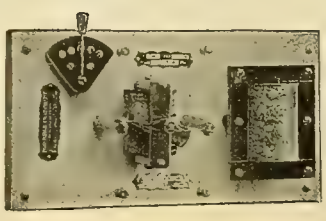

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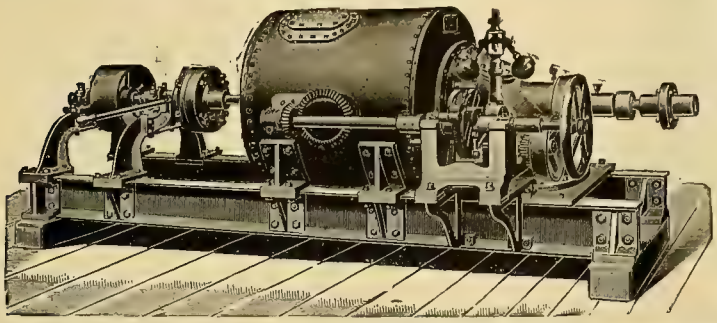

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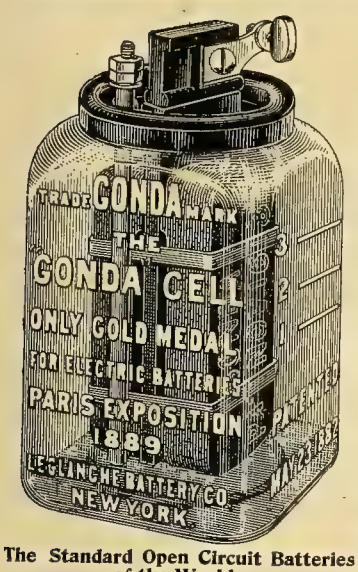

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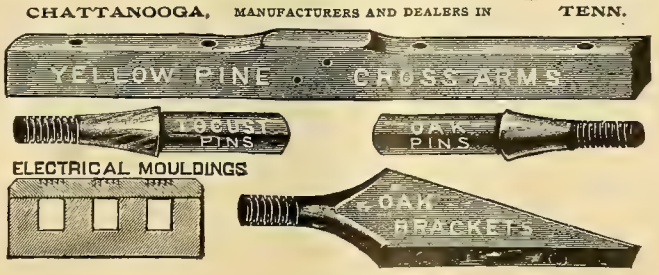

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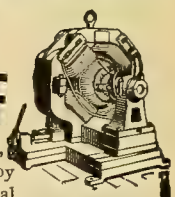

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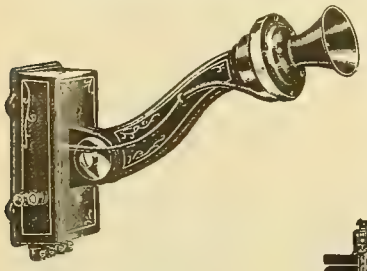

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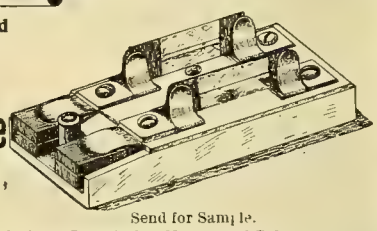

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We desire to call the attention of telephone users to the fact that the Western Telephone Construction Company's new Western Express Bridging Bell Telephone is the only high efficiency, non-infringing Bridging Telephone on the open market.

In a recent decision of the United States District Court of Pennsylvania, before Judge Buffington, the now famous Carty Patent for Bridging Telephones was sustained in a measure. This case was won by the Western Electric Company (manufacturers of apparatus for the Bell Company's Licensees) against the Milheim Telephone and Electric Company, of Pennsylvania. Shortly after bringing the suit, the American Bell Telephone Company purchased the Milheim Telephone and Electric Company, such action being taken apparently with the view to better controlling its affairs.

This decision now leaves the Western Telephone Construction Company with the only first-class Bridging Bell Telephone in the market that does not infringe claims of the Bell Company's patents. Patents granted and applied for by the Western Telephone Construction Company, secure to us an evident control of the only first-class Bridging Telephone for use in connection with long-distance lines, not susceptible to infringements of the Carty Patent in question, **in accordance with evidence given by "Carty" on the witness stand.**

N. B.—The Carty patent decision will probably be taken advantage of by unscrupulous competitors to concoct false statements. It should be borne in mind that the Carty patent is not yet finally decided and that the case, thus far, was wholly upon the validity of the patent, and no drawings nor sample nor sketch of defendant's devices was presented to the court's notice.

Our customers are assured that Bridging Instruments put out by this company for some time past are not in any way affected by the decision of the court in the case mentioned. Neither are they affected in any way whatsoever by the Carty Patent, and being absolutely free from infringement of any valid patents owned by others.

A moral is again presented to telephone purchasers and users, viz: purchase apparatus from a concern that is reliable and keeps clear of patent difficulties.

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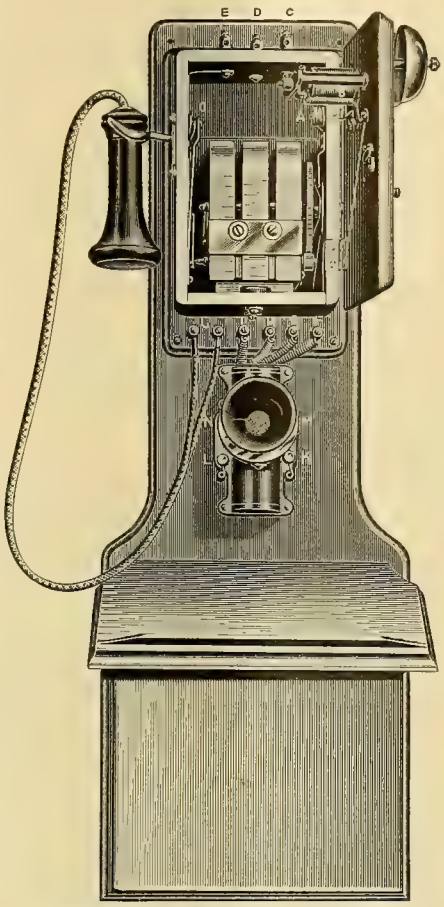

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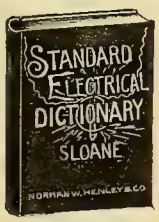

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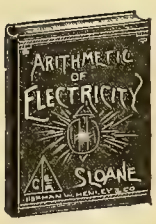

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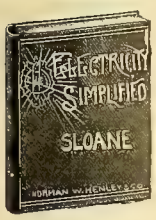

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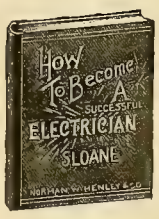

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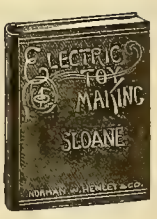

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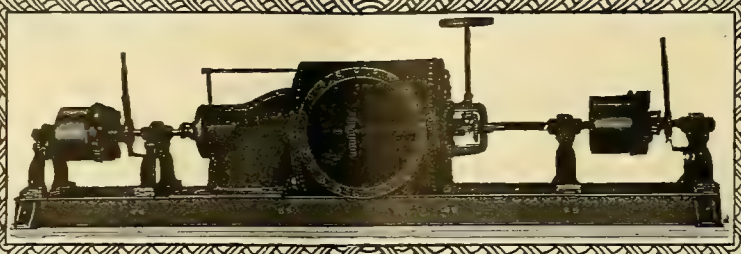

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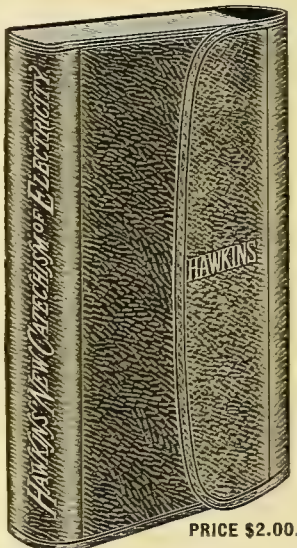

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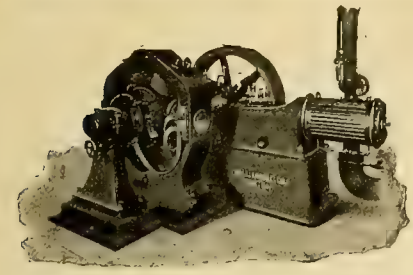

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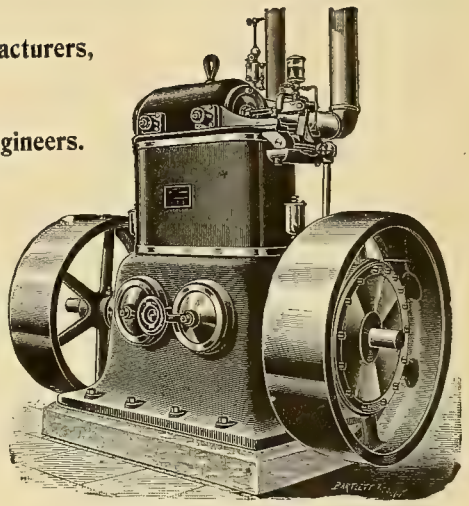

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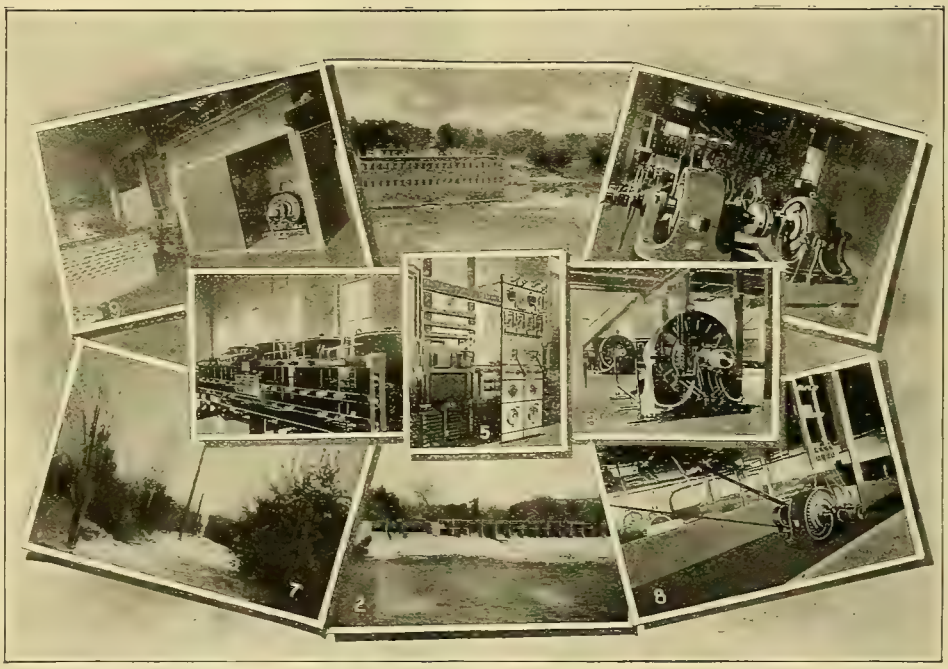

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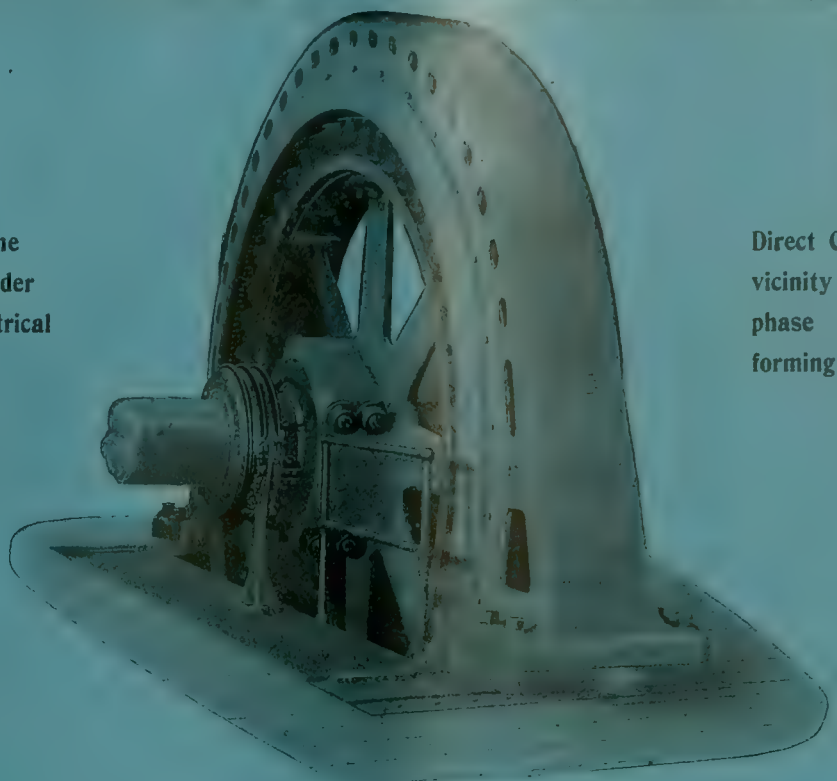

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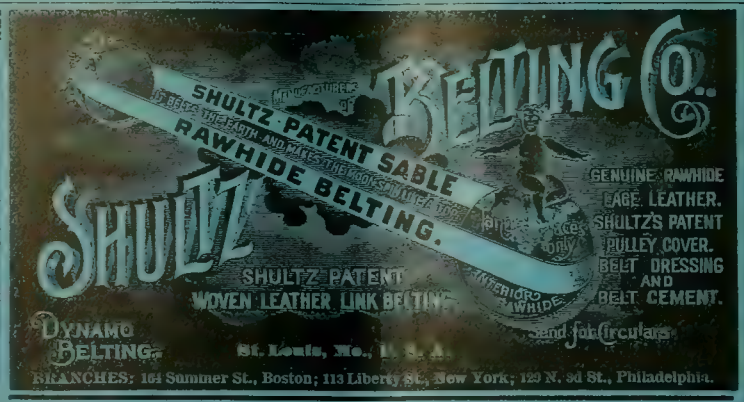

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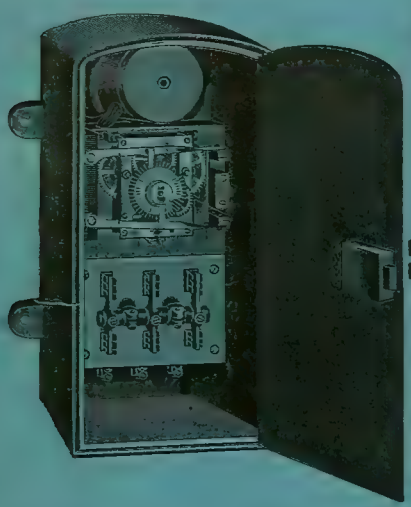

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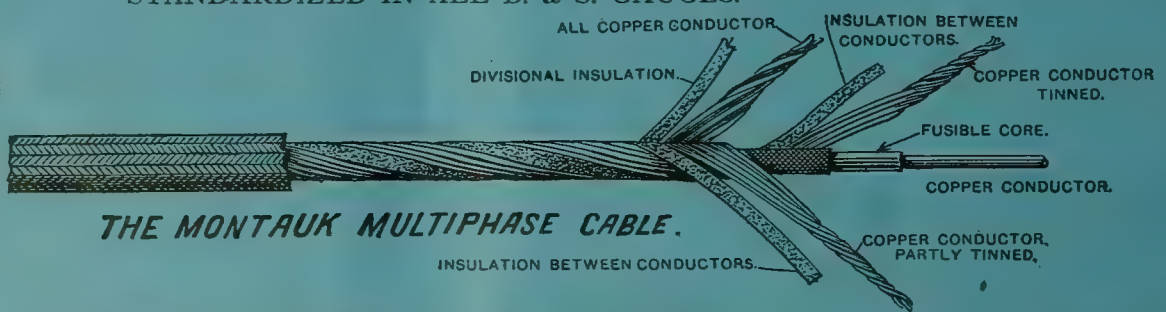

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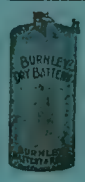

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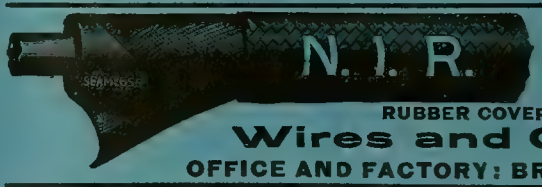

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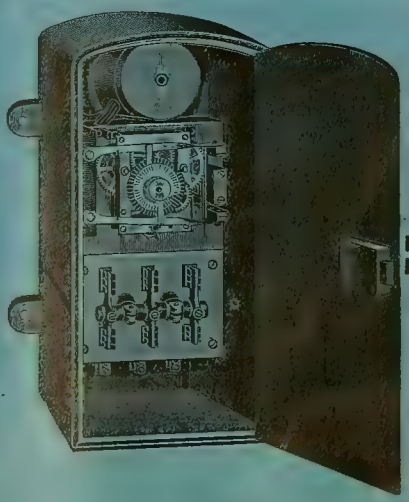

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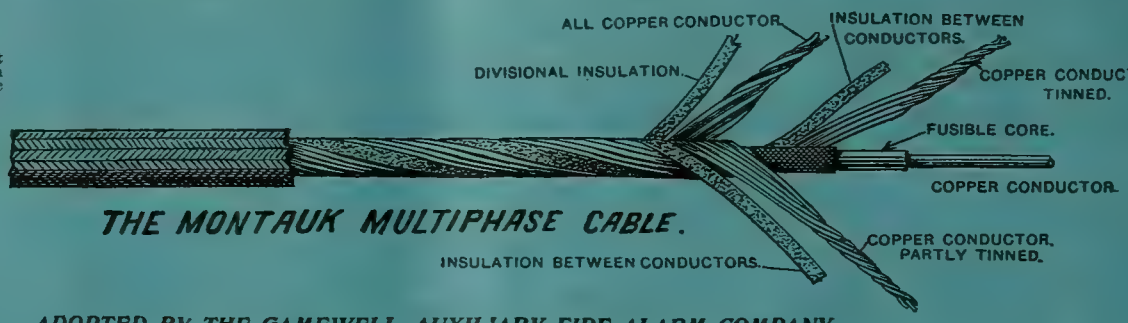

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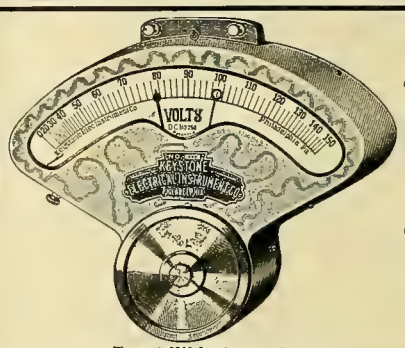

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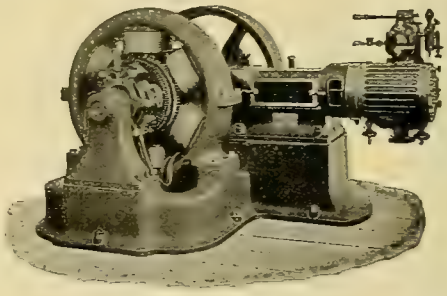

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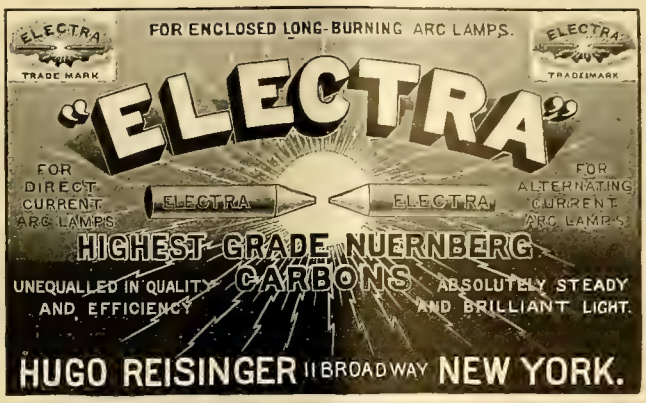

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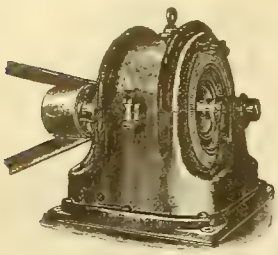

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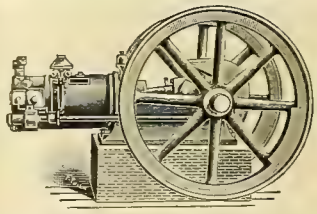

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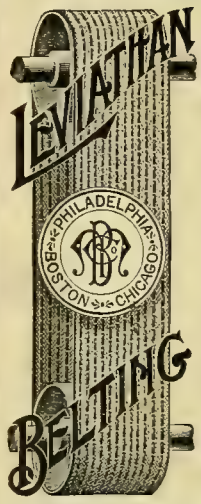

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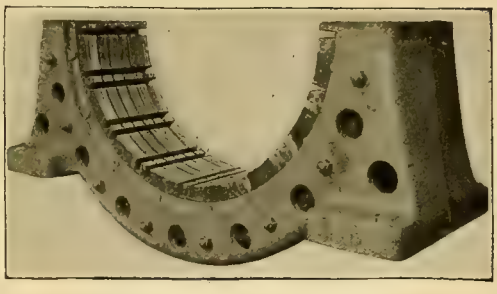

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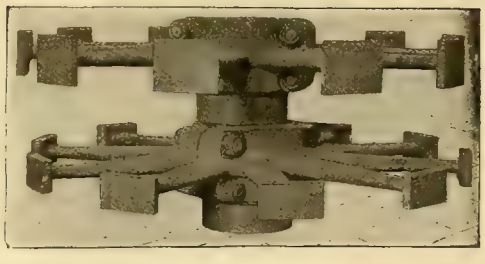

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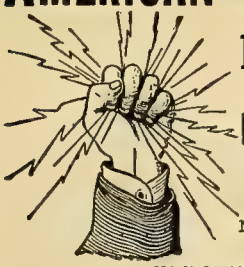

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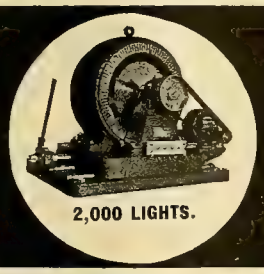

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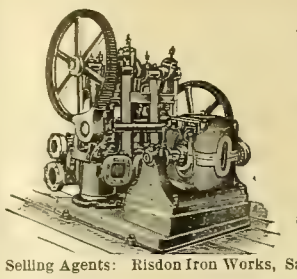

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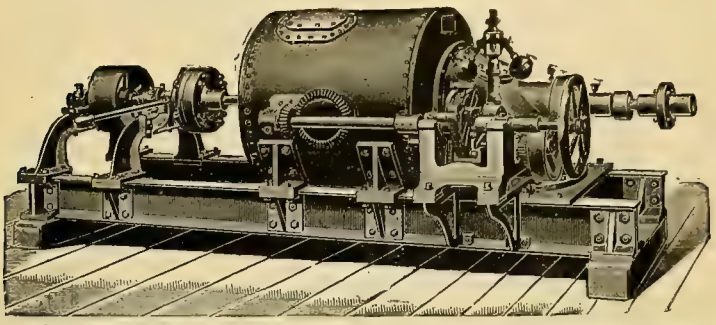

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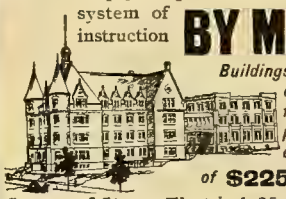

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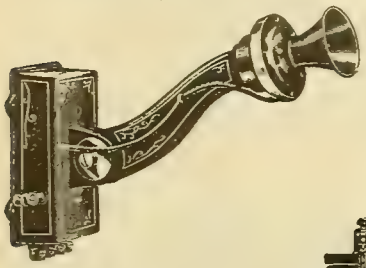

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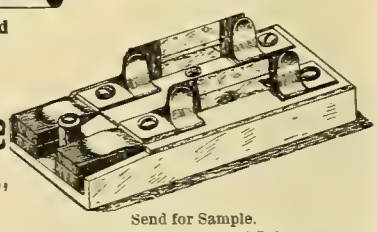

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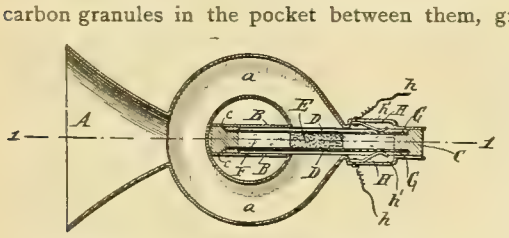

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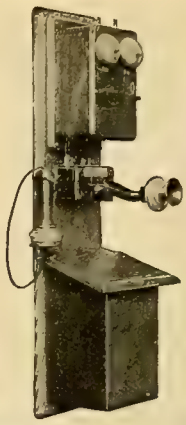

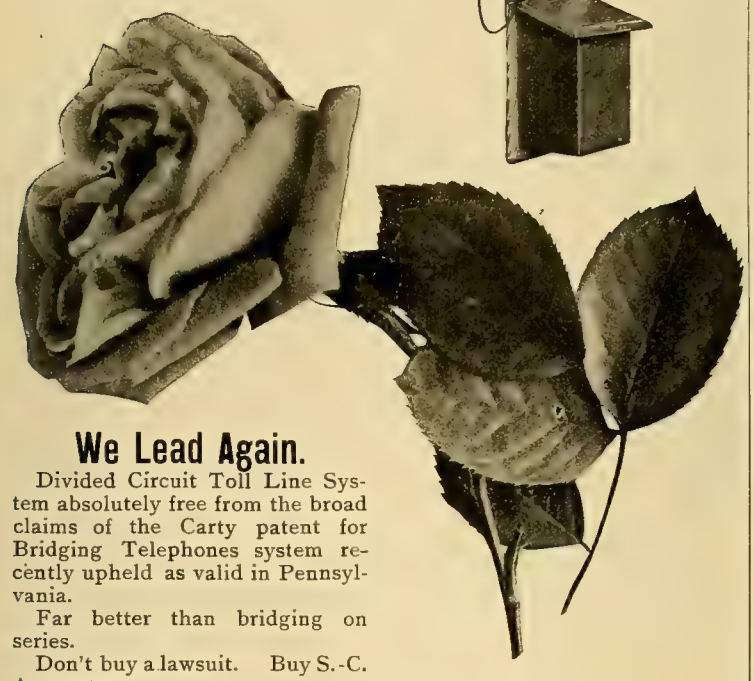

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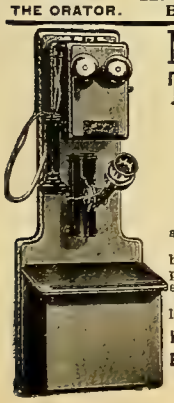

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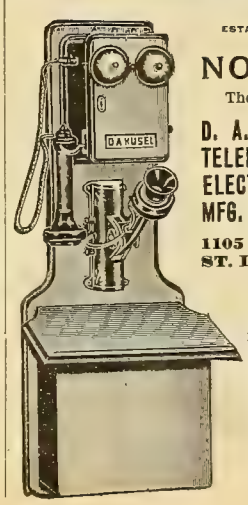

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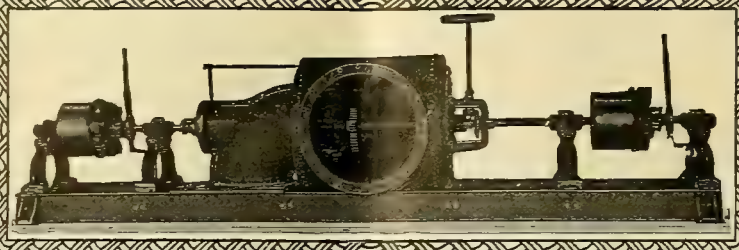

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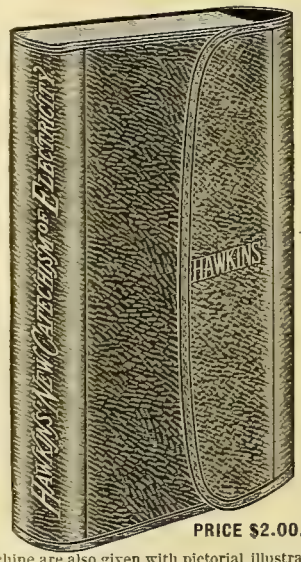

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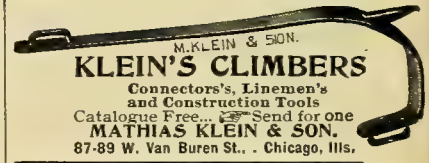

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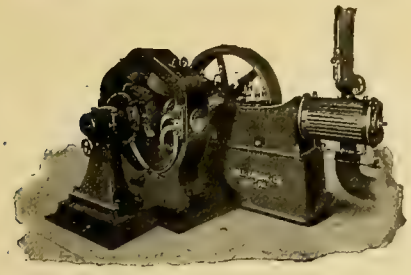

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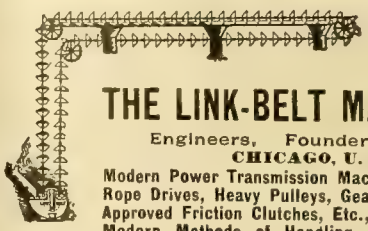

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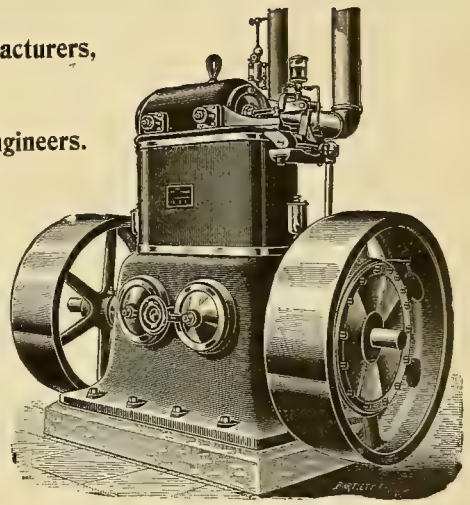

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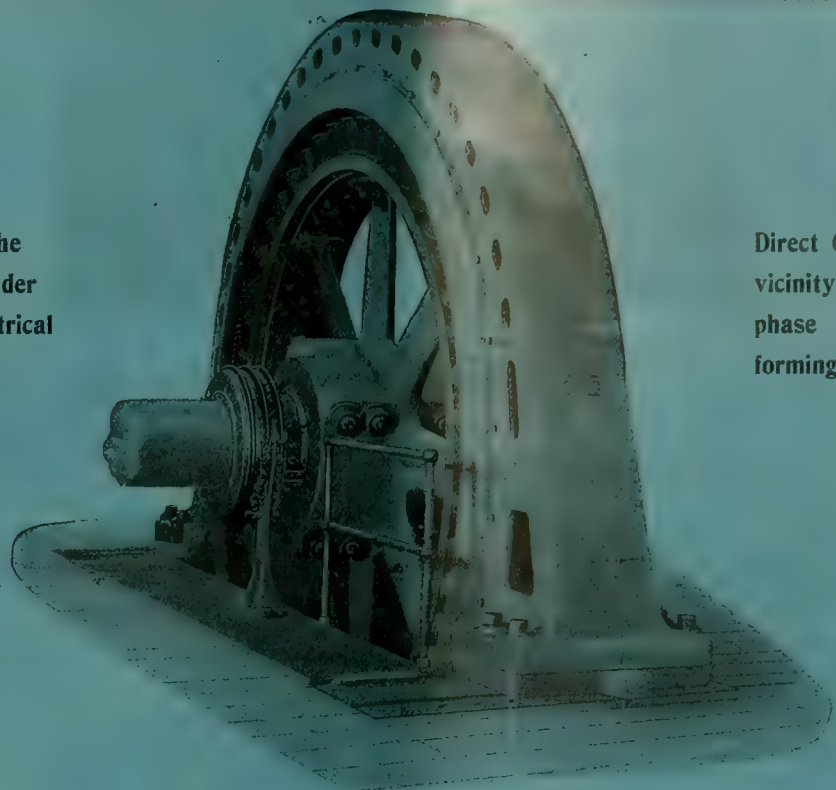

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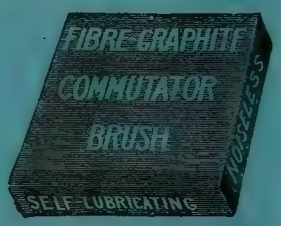

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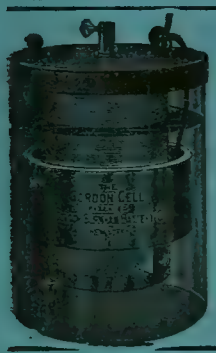

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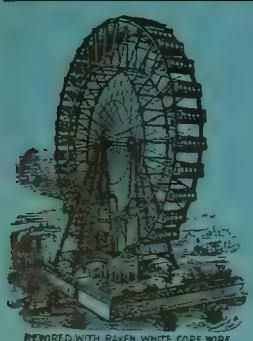

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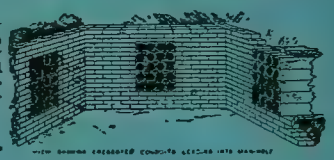

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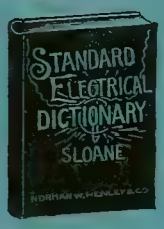

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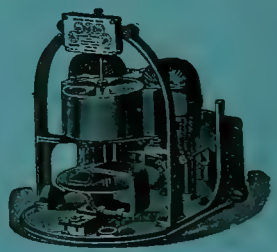

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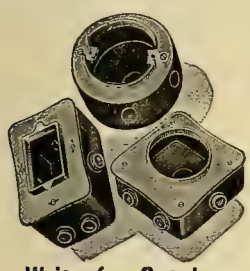

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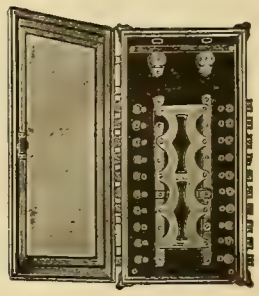

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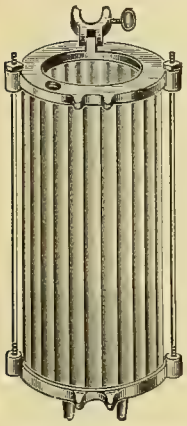

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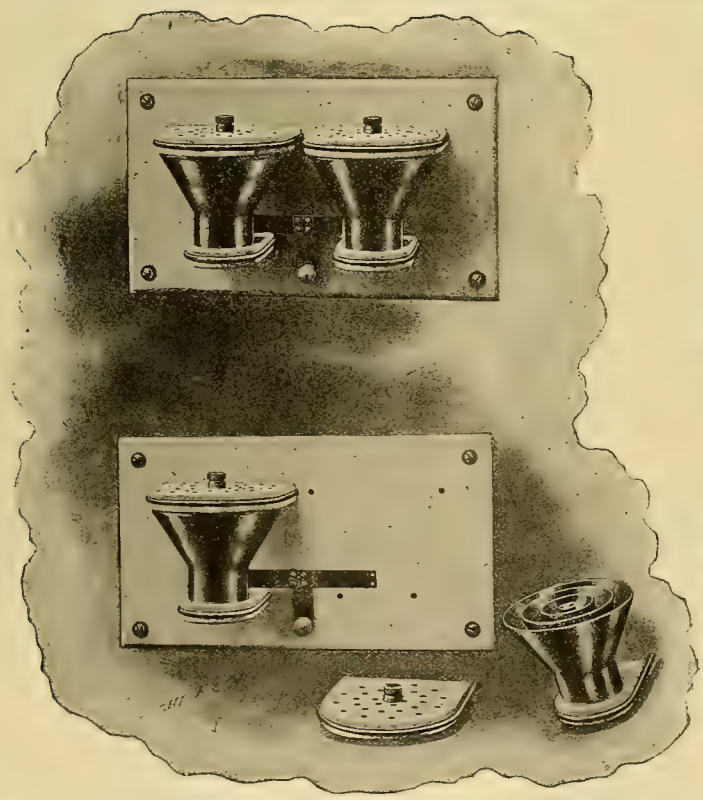

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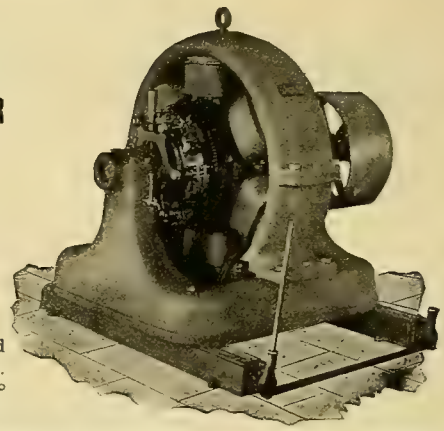

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Garlock Packing Co.
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Commercial El. Supply Co.
Mass. Chemical Co.
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Besly & Co., Chas. H.
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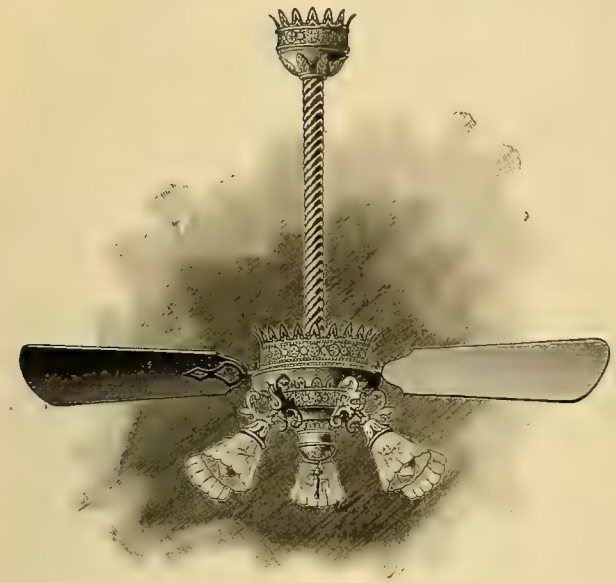

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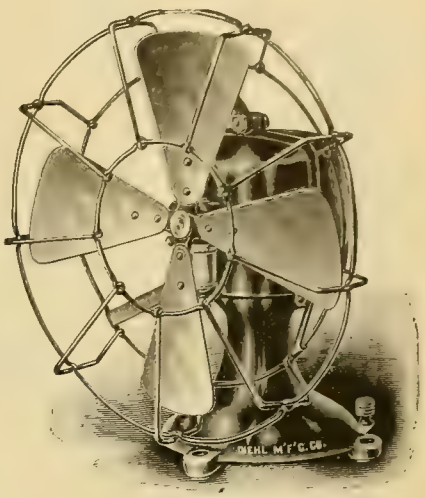

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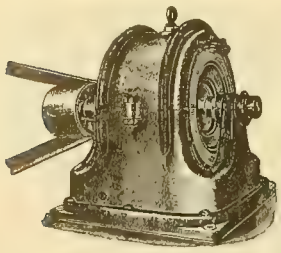

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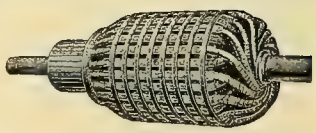

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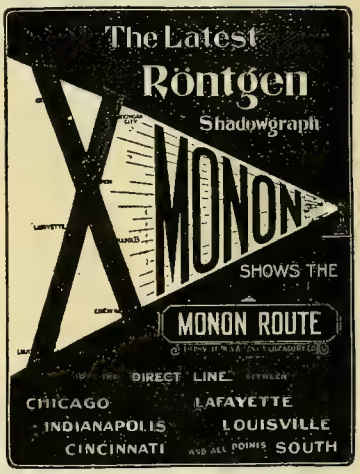

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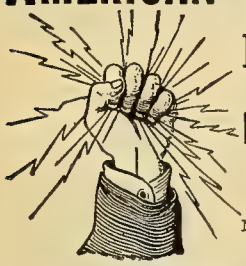

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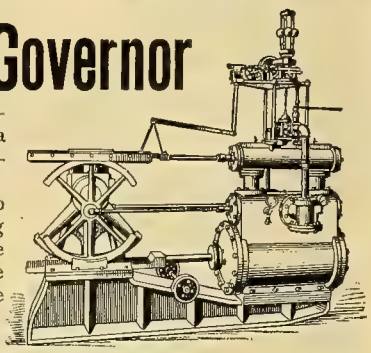

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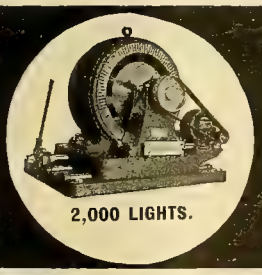

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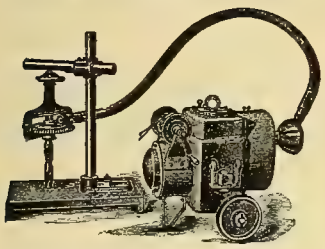

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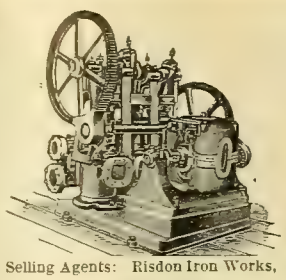

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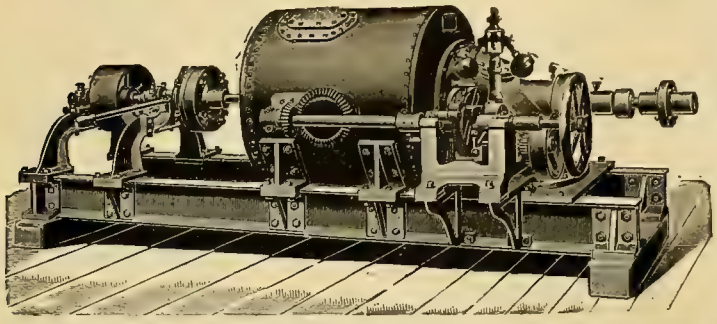

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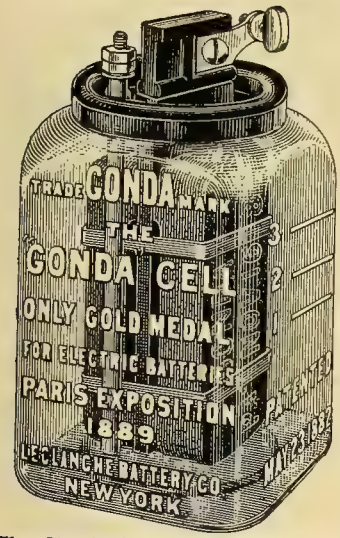

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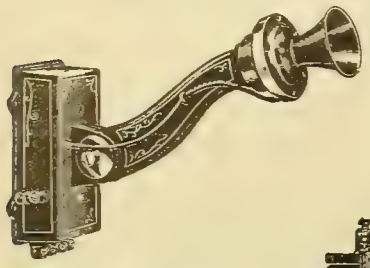

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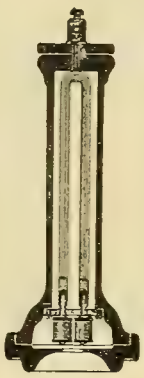

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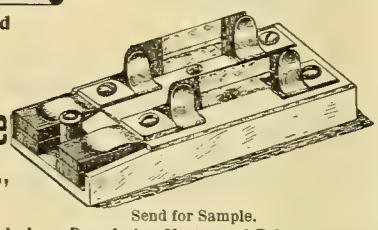

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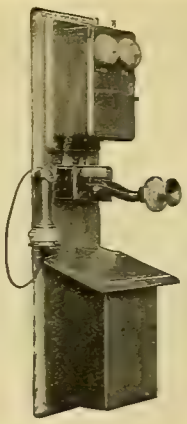

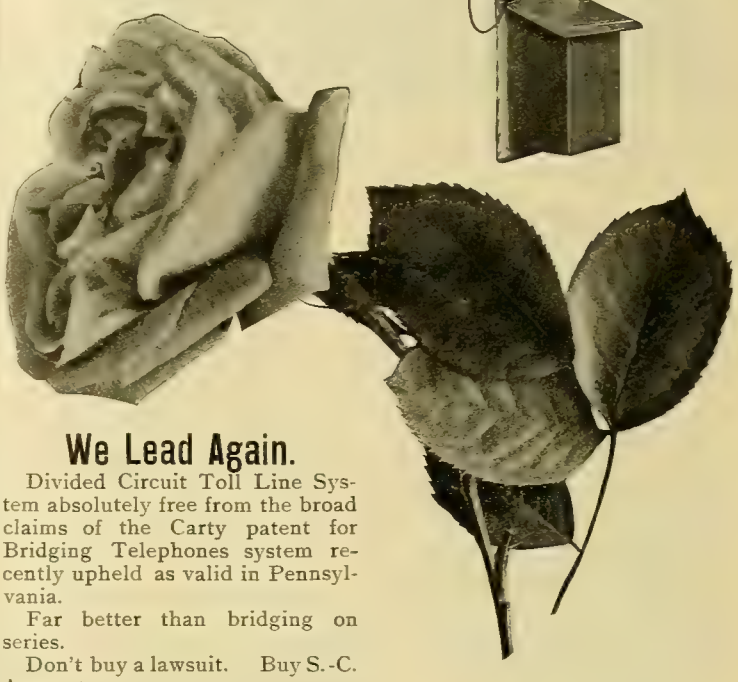

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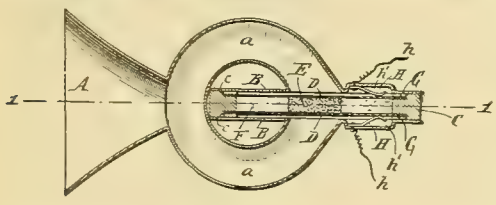

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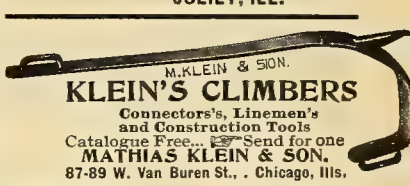

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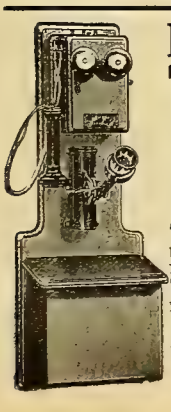

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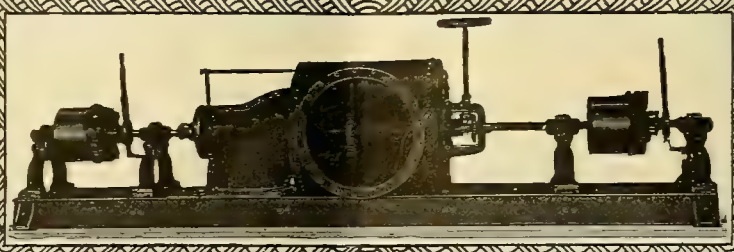

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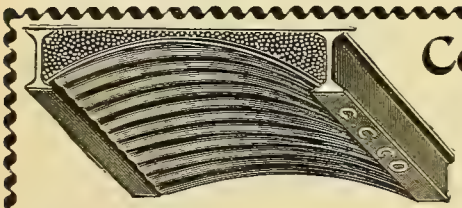

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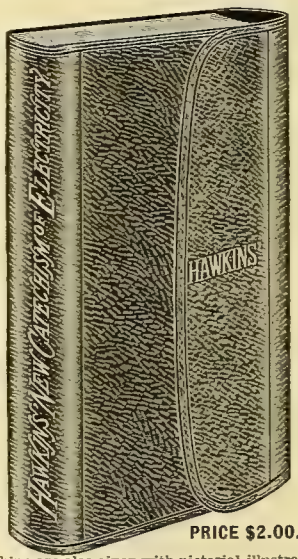

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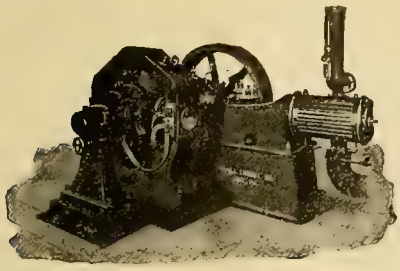

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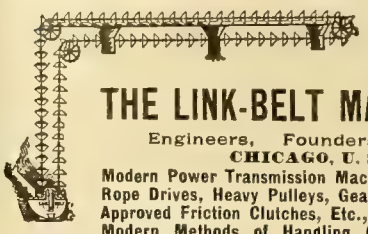

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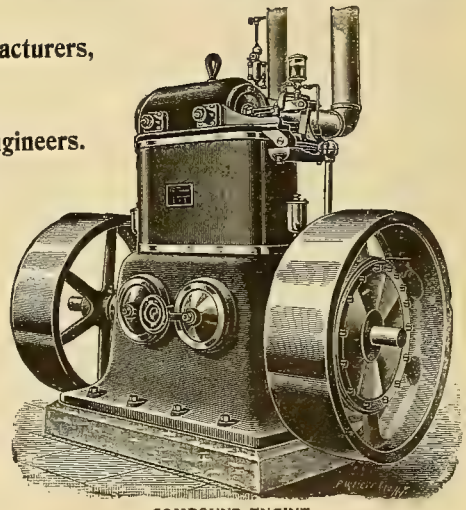

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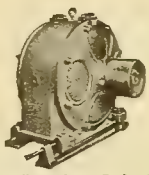

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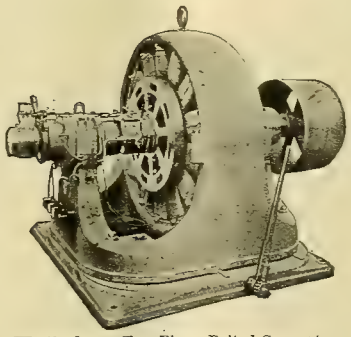

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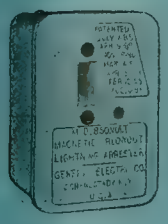

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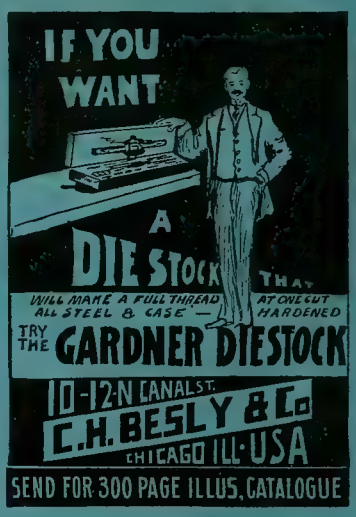

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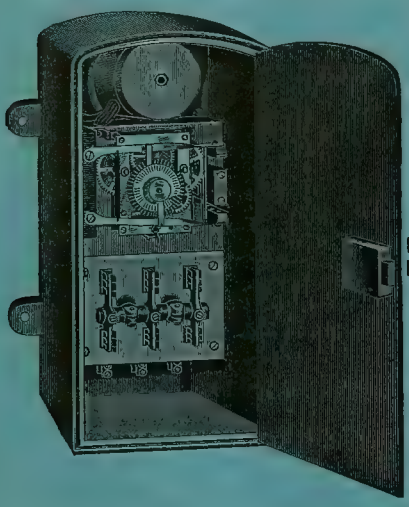

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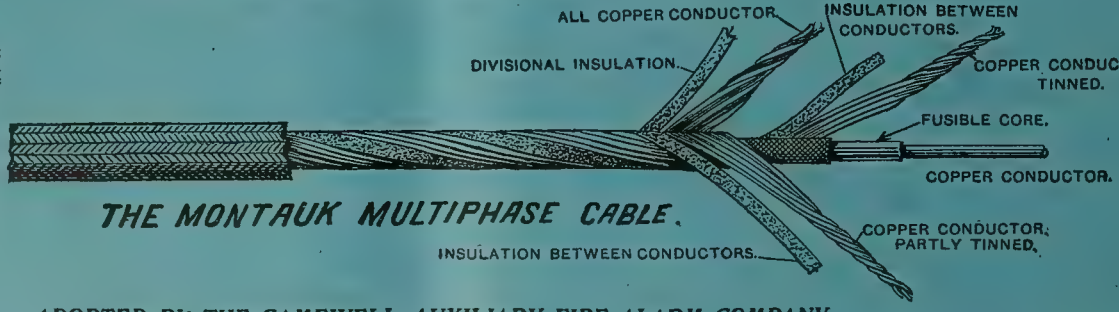

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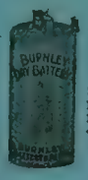

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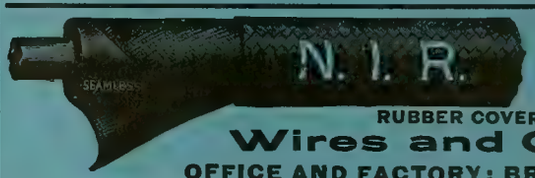

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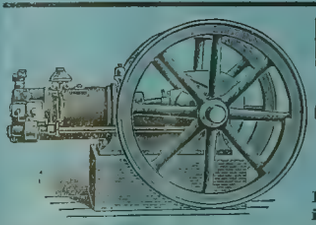

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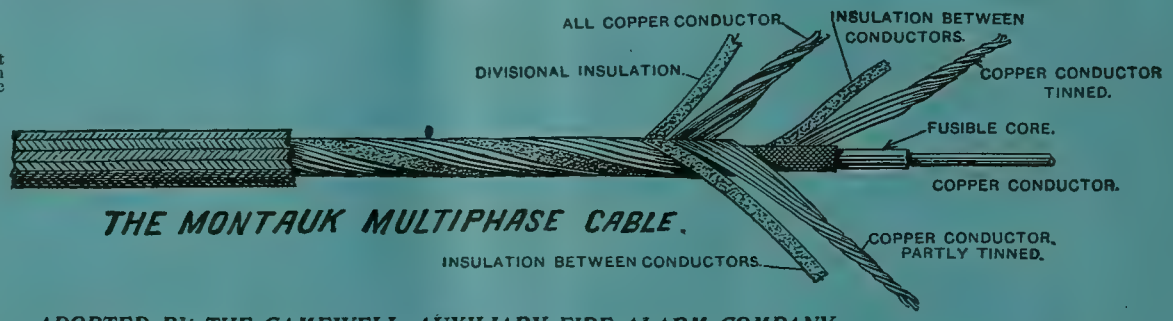

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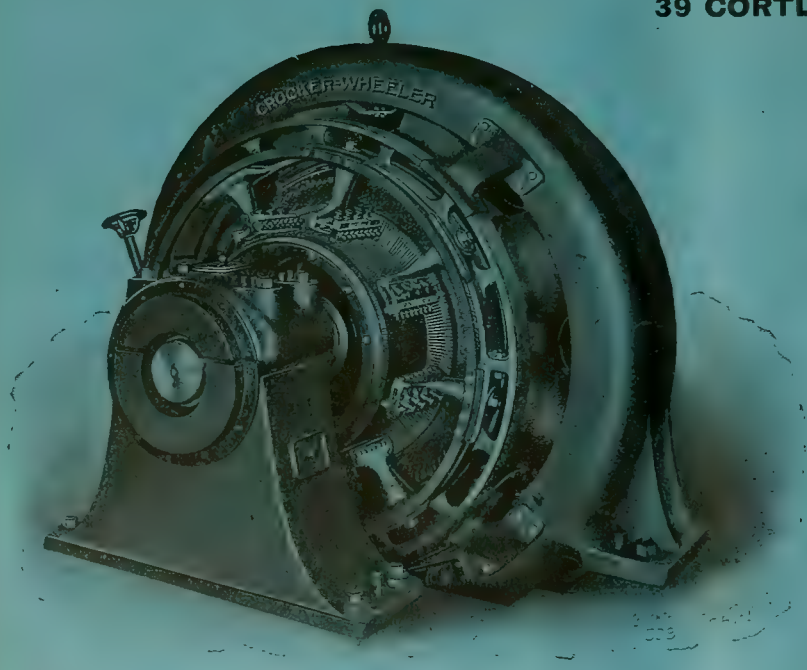

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We having received a very large shipment of

CORED CARBONS

Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

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THE NATIONAL CARBON CO.

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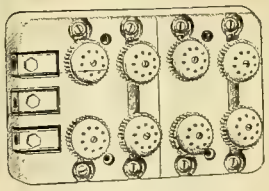
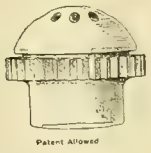


Three-Wire Multiple Circuit Tablet Board, WITH PERU PATENT FUSE PLUG.



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THE PERU FUSE PLUG, ALL PORCELAIN.

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Shafter captured Santiago, but

We will capture America.

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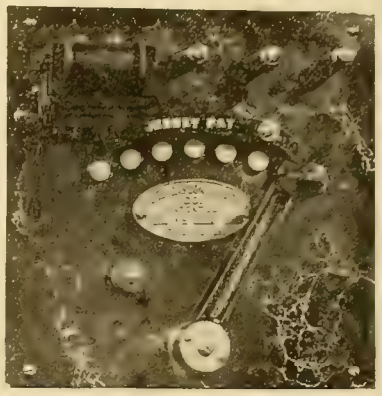
Automatic Motor Starting

CARBON RHEOSTATS.

Absolute, Fireproof, Electrically Correct, Mechanically Perfect.



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Field Regulators, constant, hot or cold.
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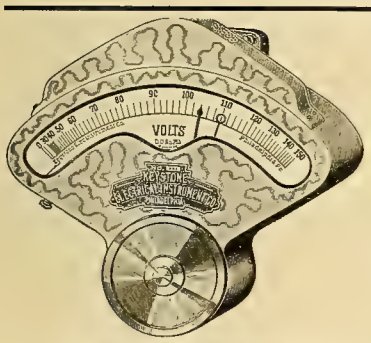

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We meet all the requirements of modern Central Stations or Isolated Plants, whether using direct or alternating current circuits.

Our instruments are constant and durable, sensitive and accurate, pleasing in appearance and always correct.

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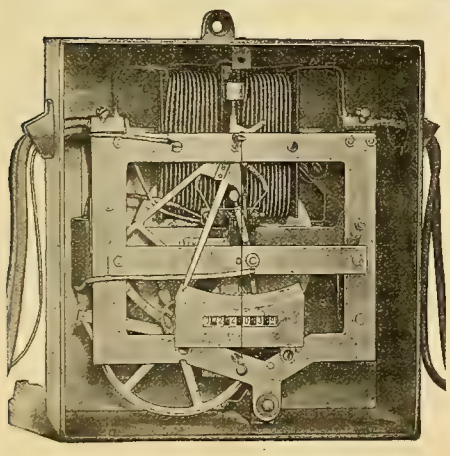

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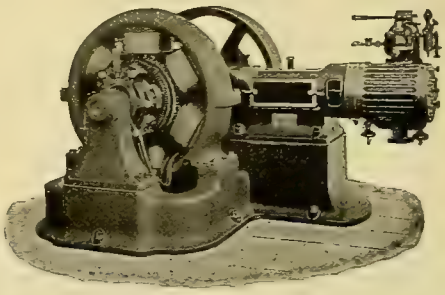

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Wagner Elec. Mfg. Co.
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Munsell & Co., Eugene.
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Okonite Co., The.
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American Engine Co.
Beck, A., Electric Co.
Bullock Elec. Mfg. Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
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Peerless Rubber Mfg. Co.

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Commercial El. Supply Co.
Mass. Chemical Co.
Standard Paint Co.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

Platinum.
Baker & Co.

Poles.
Berthold & Jennings.
Central Mfg Co.
Electric Ry. Equipment Co.
Lindsley Bros.
Michigan Pipe Company.
Torrey Cedar Co.
Valentine-Clark Co.

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Commercial El. Supply Co.
Empire China Works.
Peru Elec. Mfg. Co.

Refiners.
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Westinghouse El. & Mfg. Co.

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Central Electric Co.
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Illinois Electric Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
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Telephones, Telephone Material and Switchboards.
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Commercial El. Supply Co
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Holtzer-Cabot Electric Co.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
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Zincs.
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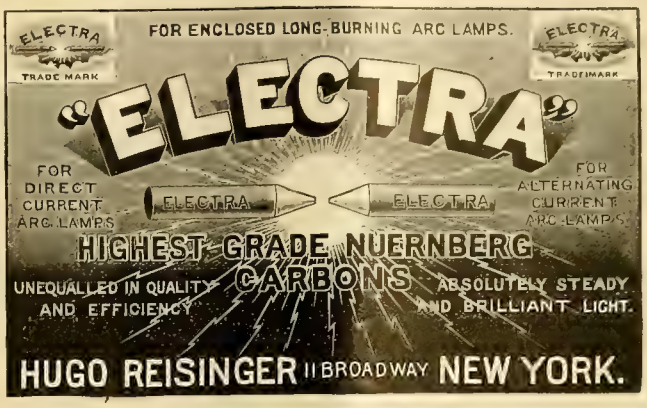

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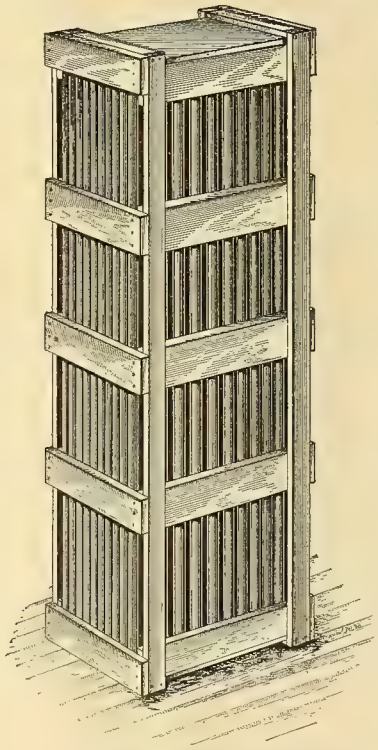

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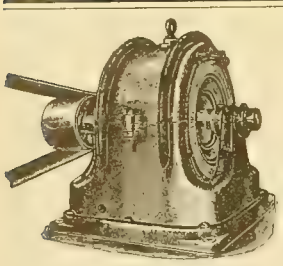

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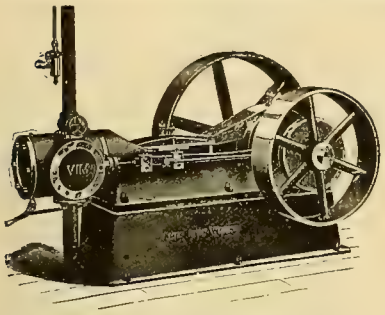

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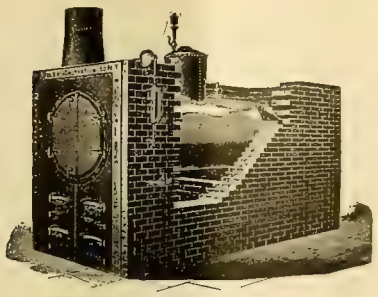

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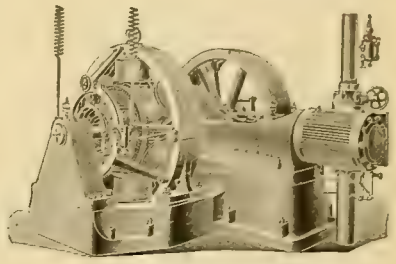

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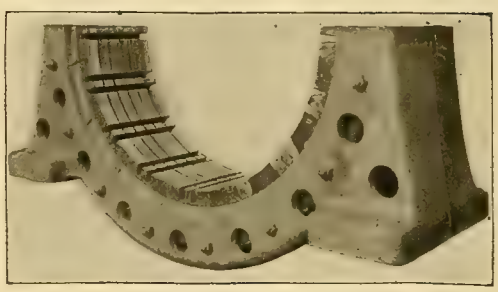

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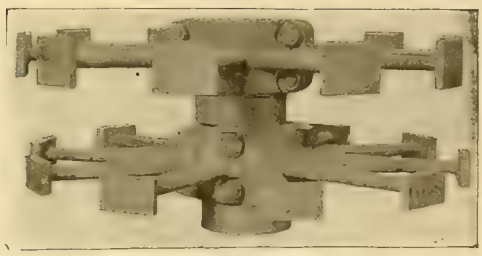

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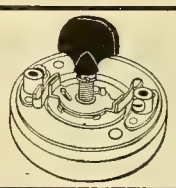

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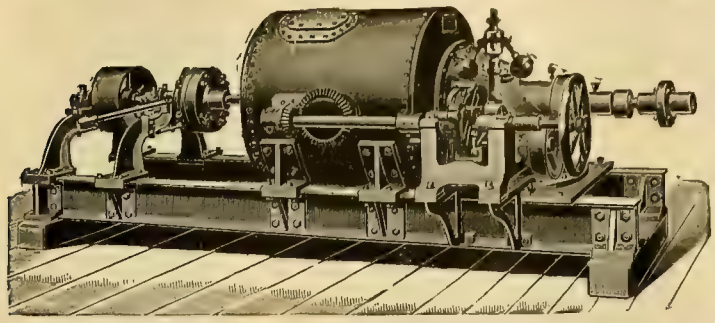

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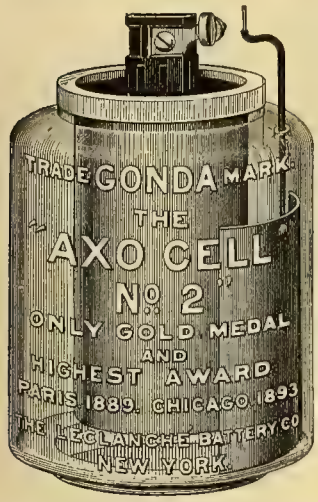

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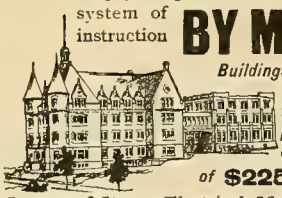

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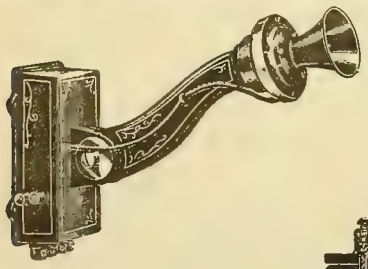

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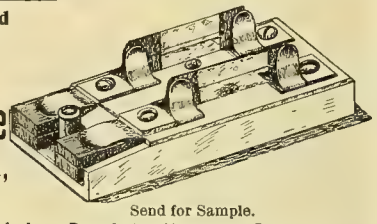

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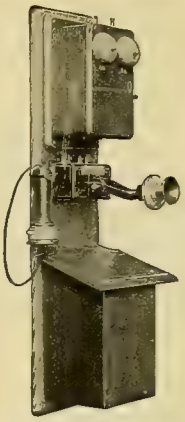

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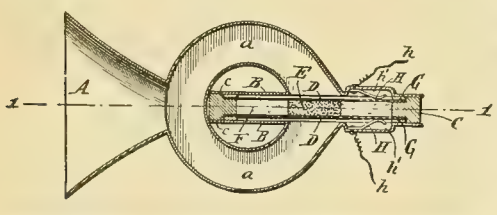

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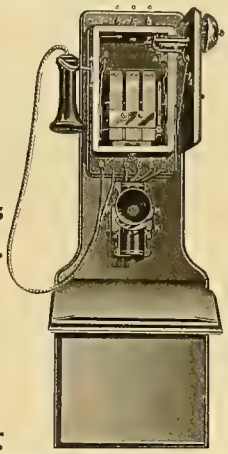

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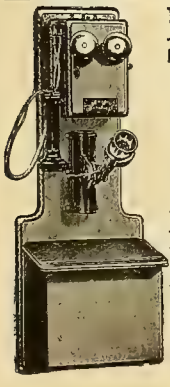

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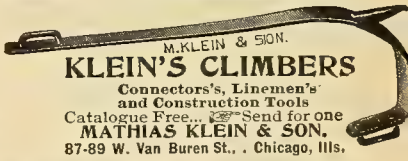

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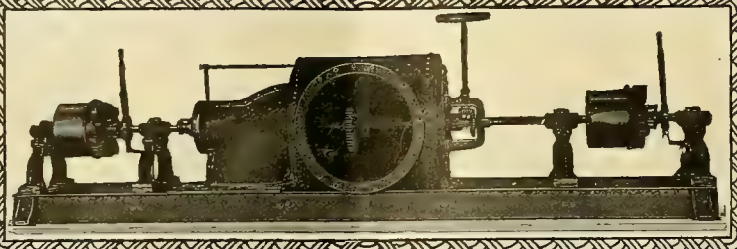

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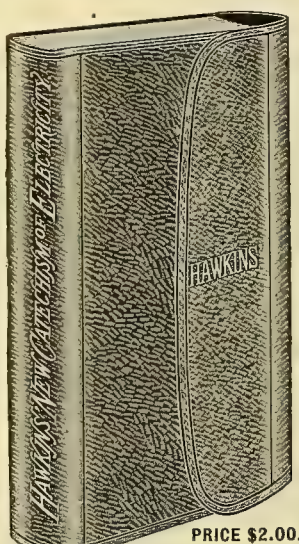

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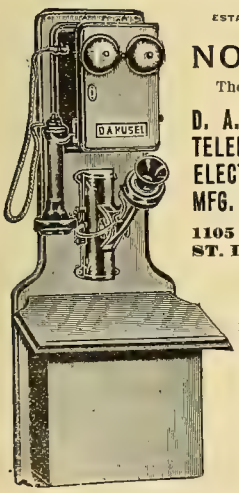

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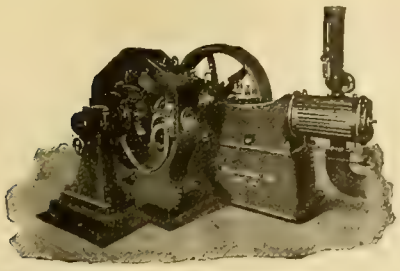

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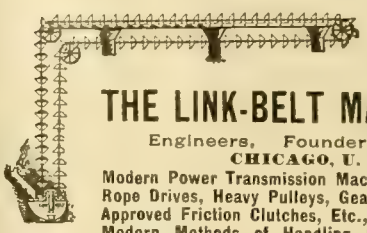

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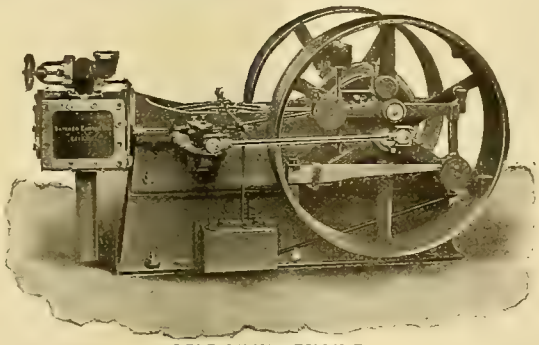

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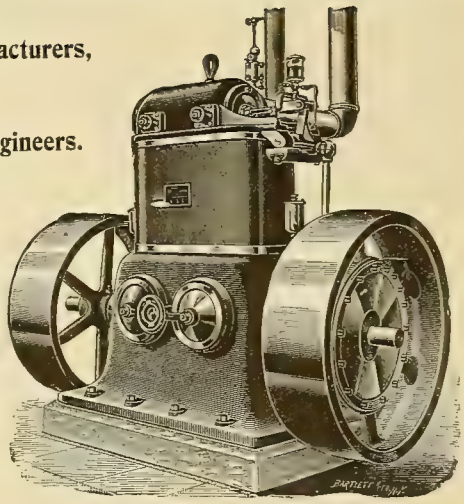

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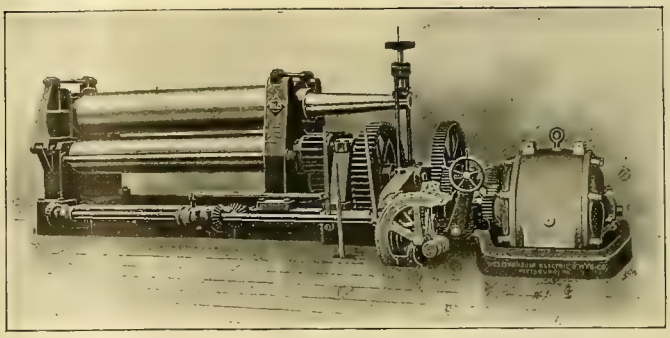

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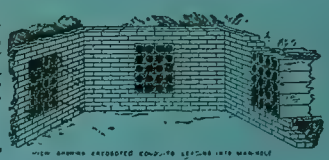

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In the month of January, 1896, before the batteries were installed, it was found necessary to run the auxiliary engine some 180 hours to supplement the water wheel. During January, 1898, after the batteries were installed, the same conditions as regards water power prevailed, and the station load was 33 per cent heavier, yet it was necessary to run the auxiliary engine only 13 hours during the month.

We have also abandoned entirely the use of the water wheel governor since the batteries were put in, these serving to maintain satisfactory regulation, the hand gate being used to take care of the large and gradual changes of head and load.

During the winter we frequently discharge the battery at the rate of 75 amperes for two hours or more to carry the peak of the lighting load, its nominal rating being 50 amperes. It also carries the load during the day and after midnight without any attendance whatever. [Signed] W. A. HESSELTINE, Supt.

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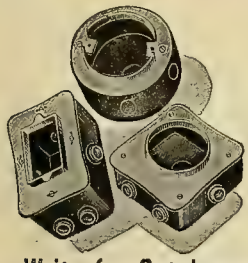

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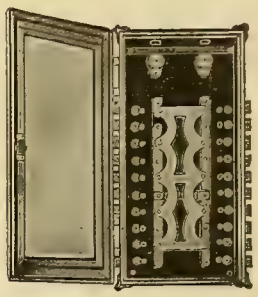

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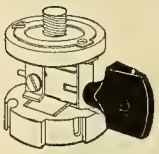

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New York Insulated Wire Co.
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Hobart Elec. Mfg. Co.
Illinois Electric Co.
Insull, Martin J.
Sargent & Lundy.
Stanley Elec. Mfg. Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Wray Co., John C.

Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

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Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
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Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

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Berthold & Jennings.
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Electric Ry. Equipment Co.
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Michigan Pipe Company.
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Chicago Edison Co.
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Electric Appliance Co.
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Queen & Co.
Weston Electrical Inst. Co.

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Bossert Elec. Const. Co.

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Crofton Storage Battery Co.
Electric Storage Battery Co.
Lockie & Viall.

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Stephenson Co., John.

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American Electrical Works.
Brixey, W. R.
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Cabinet Mfg. Co.
Commercial El. Supply Co
Ericsson Telephone Co.
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Holtzer-Cabot Electric Co.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. & Tel. & El Mfg. Co
Northwest Engineering Co
Pickett, A. B.
Rawson Electric Co.
St. Louis El. Supply Co.
Standard Tel. & El. Co.
Star Dynamo Works
Sterling Electric Co
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Stromberg-Carlson Tl. M. Co
Viaduct Mfg. Co.
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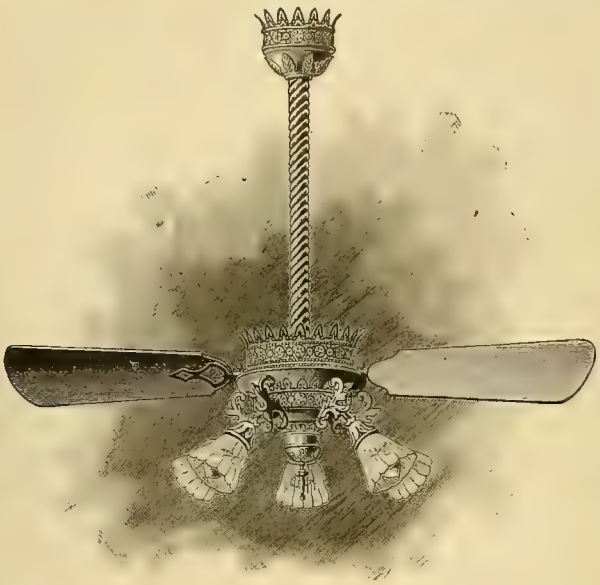

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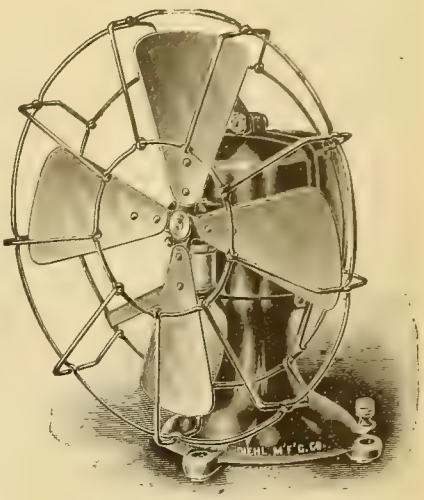

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The renewal of lamps makes this possible.

If you prefer new lamps, we can supply you with the best and allow you three cents each for your burned out lamps.

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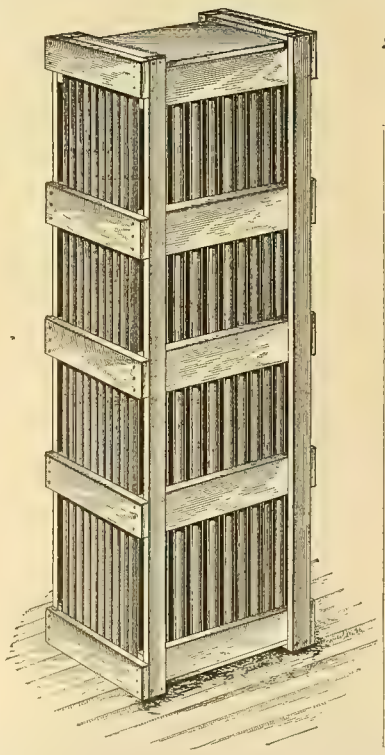

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Our Price the Lowest, Our Tube of the Best Quality.

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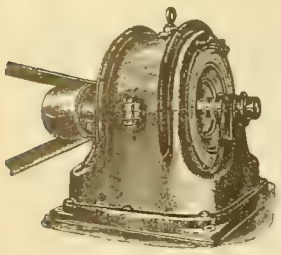

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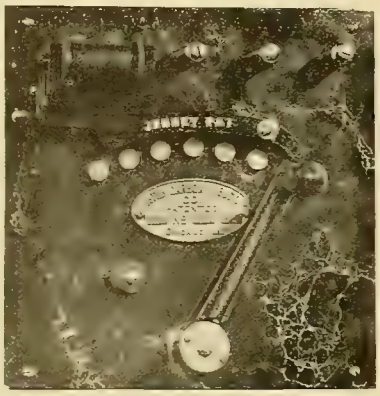

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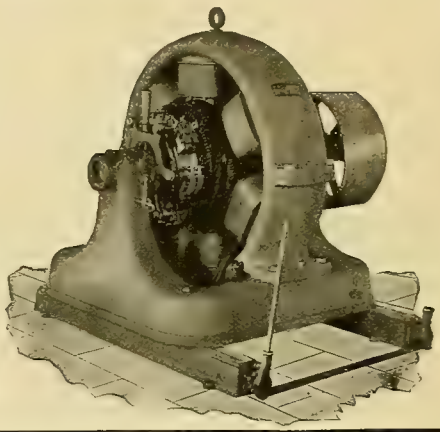

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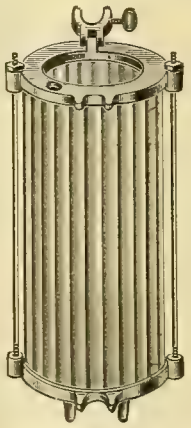

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Absolutely free from **side shadows,** or those cast by flying insects.
Diffuses light uniformly.
Easily attached and detached.
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Made for all styles of arc lamps.
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Armatures Rewound.

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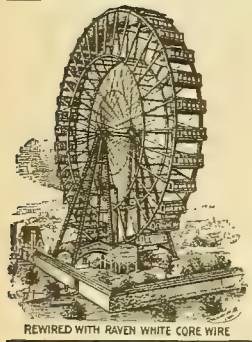

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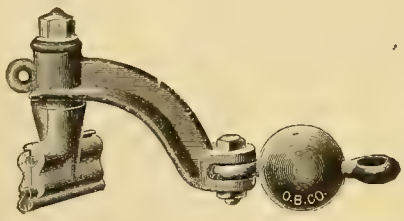

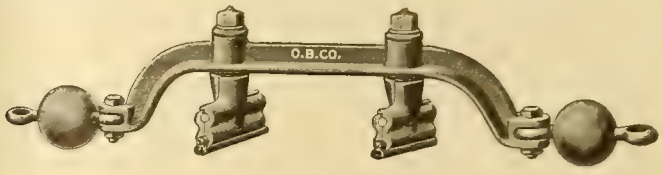

Headquarters

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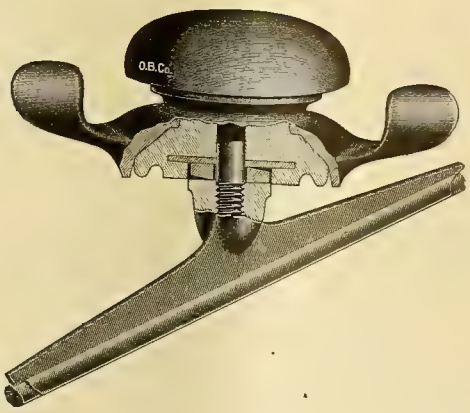
Electric Railway Supplies.



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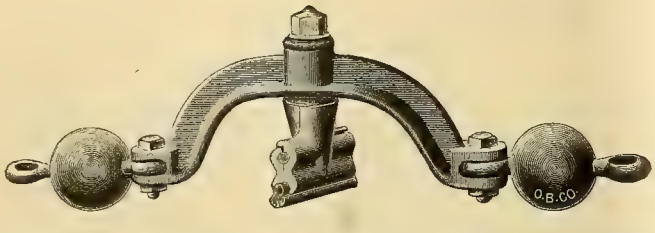

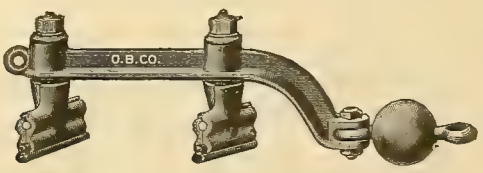

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Form a very important item in line construction, whether for electric light or telephone work. Inferior goods in this line always make very serious trouble. All of our Pins and Brackets are made either from the best split live oak or selected locust, and are warranted sound and strong. Prompt shipments from Chicago stock at lowest prices.

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Entirely Automatic and Absolutely Reliable. Also
ARC CUT-OUTS for High Tension Arc Circuits. The BEST APPLIANCES of the Kind are Manufactured by
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NOTHING
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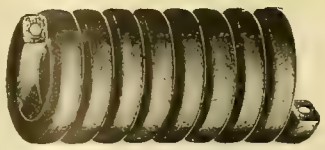

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Cheap, Light, Durable, Efficient. Motocycle Batteries a Specialty.
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Gale's Commutator Compound

50 Cents Per Stick. $5.00 Per Dozen.
The only article that will prevent sparking. Will keep the commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
It will put that HIGH GLOSS on THE COMMUTATOR you have so long sought after.
FOR SALE BY ALL SUPPLY HOUSES, OR

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Apparatus for
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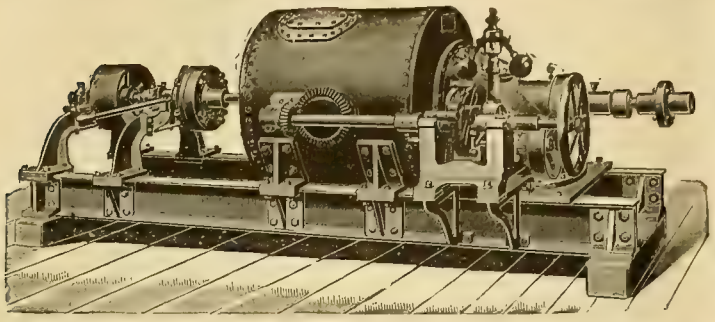

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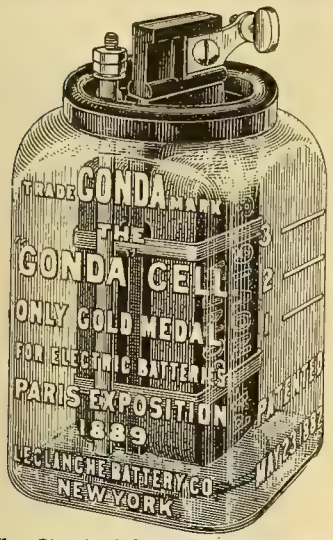
THE STILWELL-BIERCE & SMITH-VAILE CO., DAYTON, OHIO.



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Of a railway system running between Chicago, Milwaukee, St. Paul, Minneapolis, Ashland and Duluth, known as the Wisconsin Central Lines. Before making a journey to any of these northwestern points, inquire relative to the fast and elegantly equipped trains which leave Chicago daily via the Wisconsin Central. Your nearest ticket agent can give you complete information.

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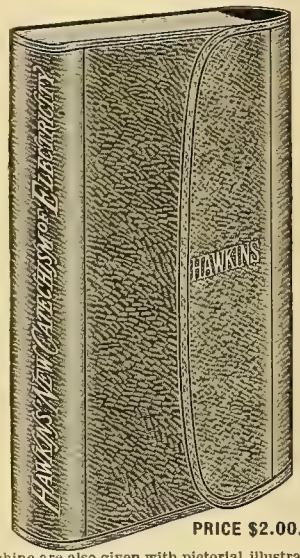
HAWKINS' NEW CATECHISM OF ELECTRICITY.

Plan of the Work, Contents, Etc.



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The book is, first of all, intended to be plain and instructive; some 300 illustrations have been introduced, so that the mere pictures will afford almost a knowledge of the subjects.

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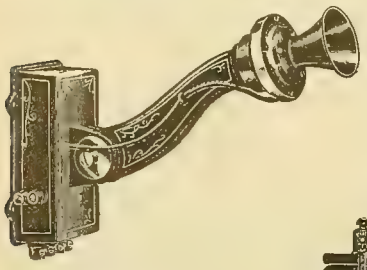

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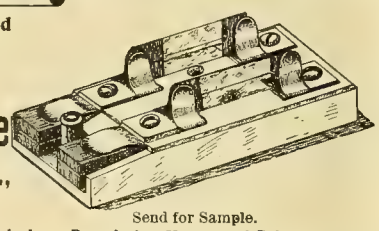

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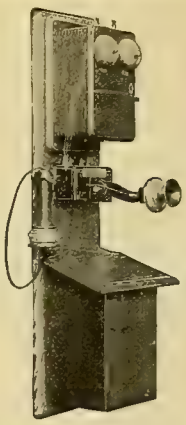

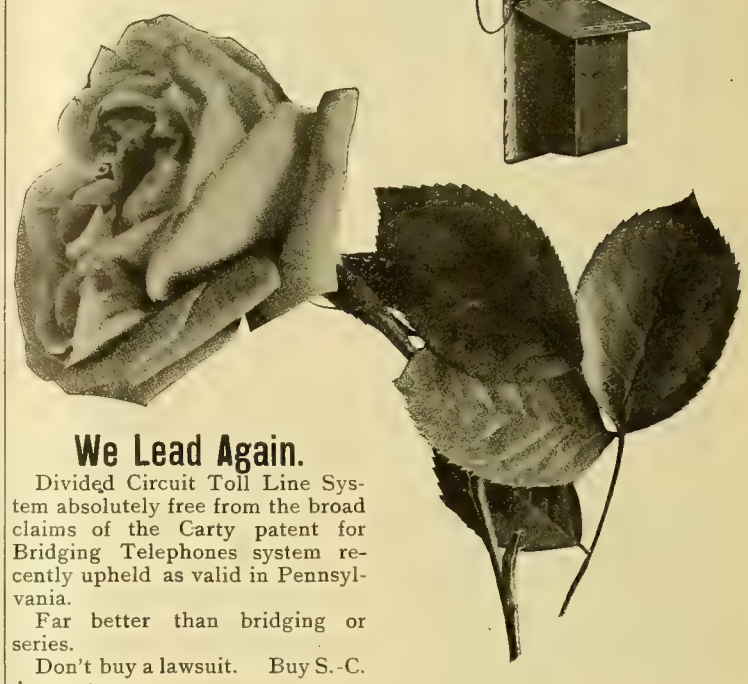

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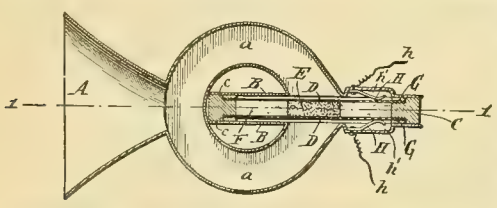

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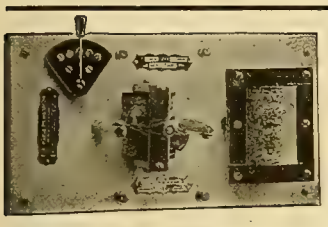

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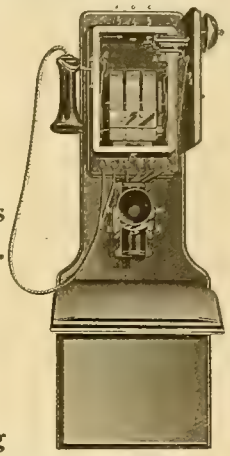

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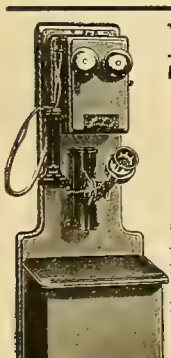

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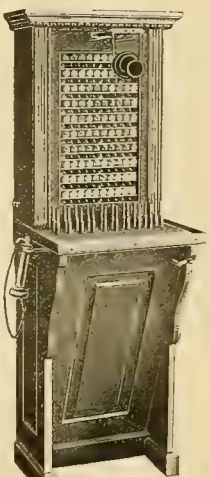

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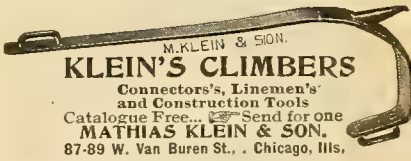

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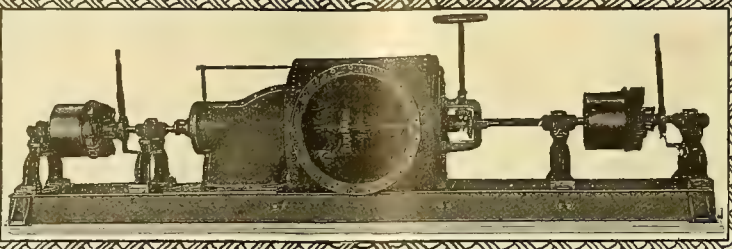

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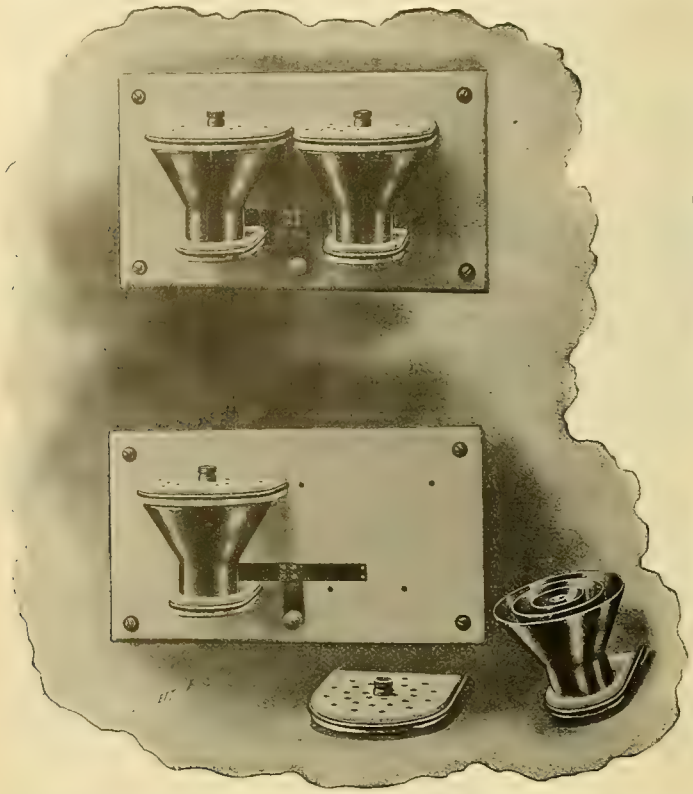

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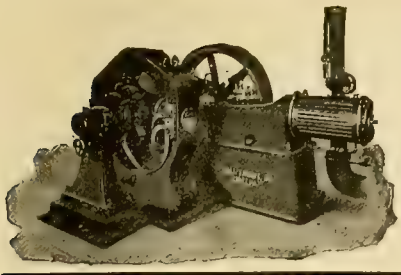

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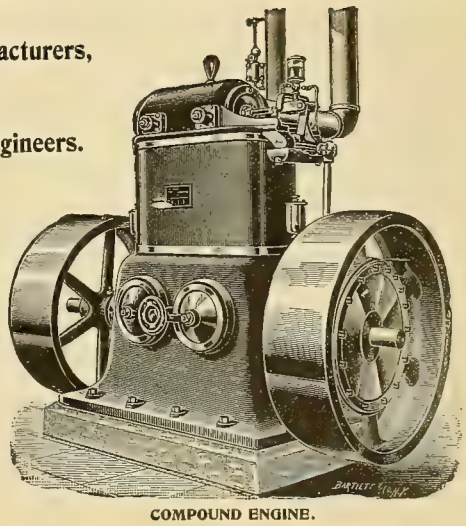

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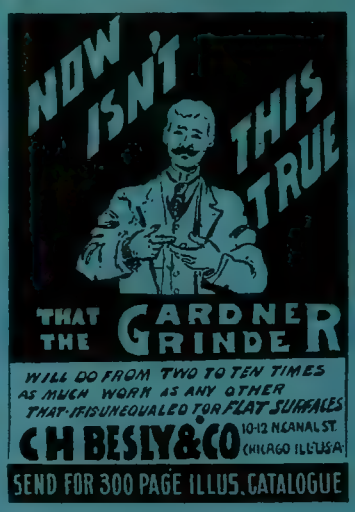

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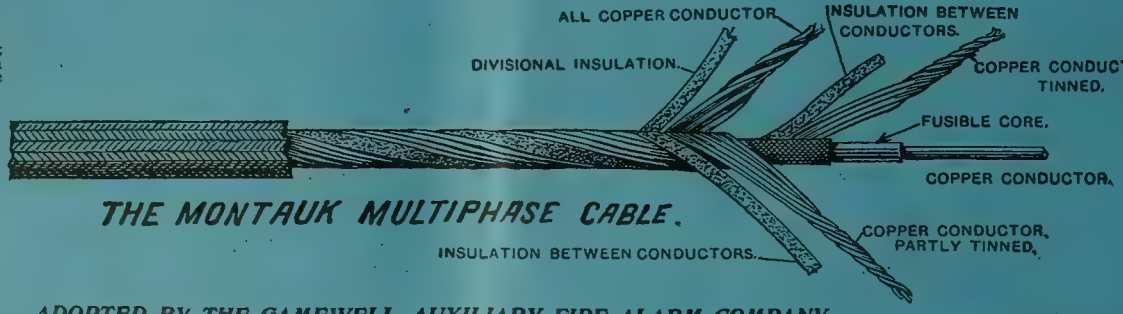

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Scrap and Native Platinum Purchased.

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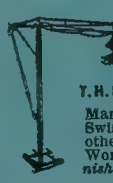

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PERFECT MECHANICAL CONSTRUCTION, HIGHEST ELECTRICAL EFFICIENCY.

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RUBBER COVERED

Wires and Cables.

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(U. S. and Foreign Patents.)

No Sparking Under Varying Load.
No Wear on Commutator.
No Shifting of Quadrant.
80 per cent. Pure Graphite.

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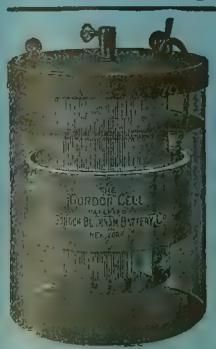

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In use by the leading cities, railroads, telephone and gas engine companies.

WE CLAIM:—Constant discharge of current without polarization; no local action; no noxious gases or fumes; no acids; least labor for operation; cleanest; not freezing at 28° below zero; economic value 50 per cent. greater than gravity cell, and 30 per cent. greater than best other cell in market. For No. 1 cell, 250 ampere hours; for No. 2 cell, 100 ampere hours; on open circuit, .9 to 1 volt; on closed circuit, .65 to $\frac{7}{10}$ volt. Send for circular and price list.

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1—1,000-light National Alternator, with exciter and instruments	500.00
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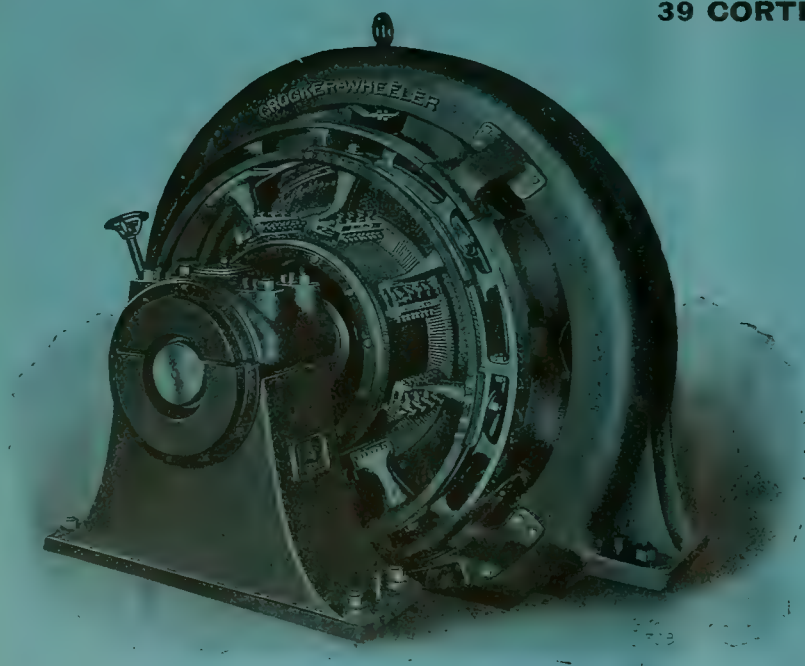

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We having received a very large shipment of

CORED CARBONS

Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

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Type "R" Instrument.

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Switchboard Voltmeters, Ammeters, Ground Detectors and Differential Voltmeters.

We meet all the requirements of modern Central Stations or Isolated Plants, whether using direct or alternating current circuits.

Our instruments are constant and durable, sensitive and accurate, pleasing in appearance and always correct.

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Generators,
Motors,
Direct-Connected,
Slow Speed,
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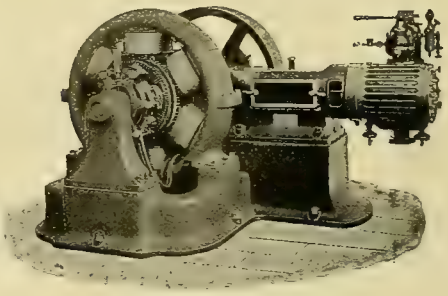
Mining Locomotives.



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ELECTRIC MACHINERY.

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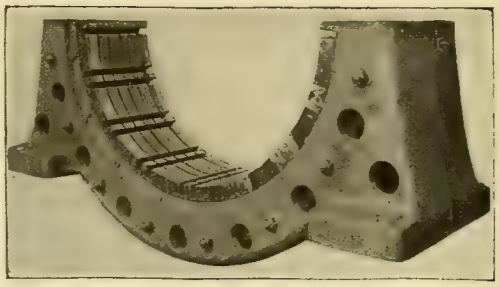

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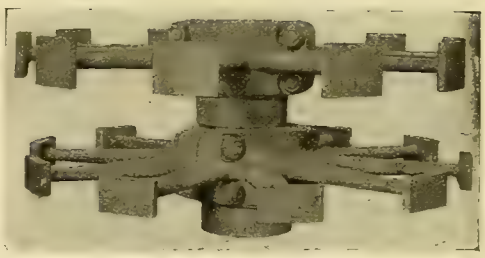

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For Enclosed Arcs.

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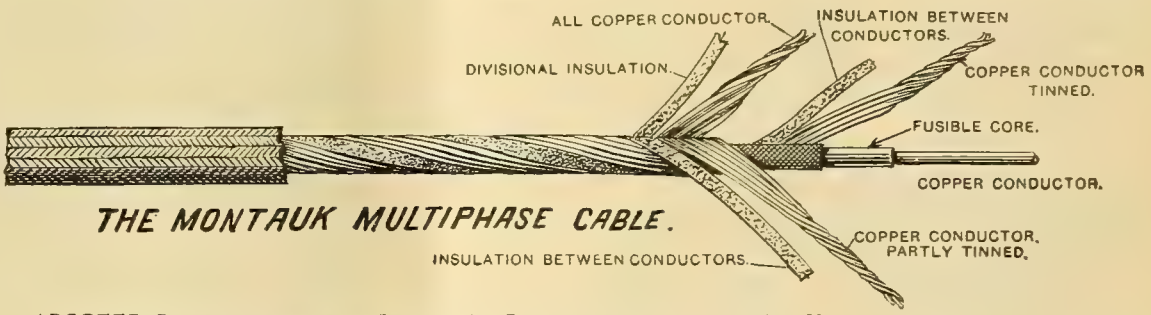

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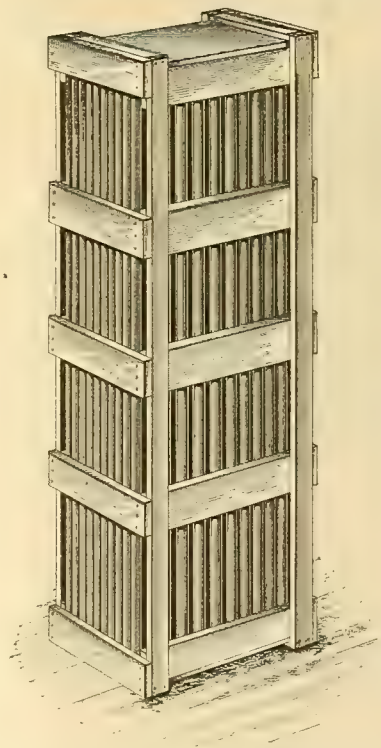

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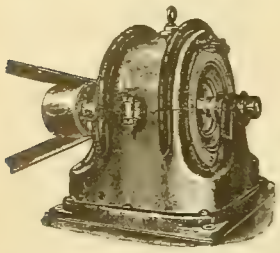

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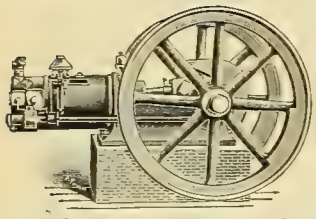

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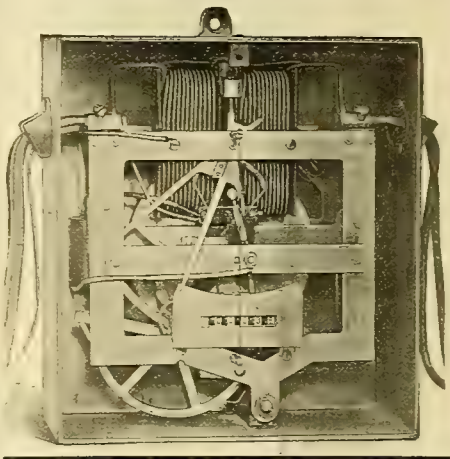

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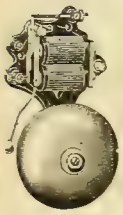

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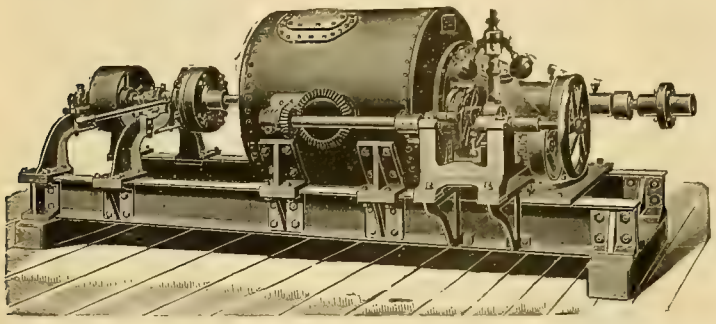

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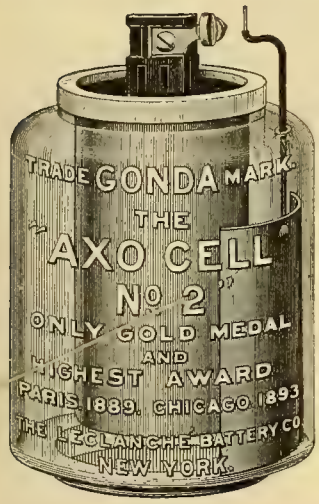

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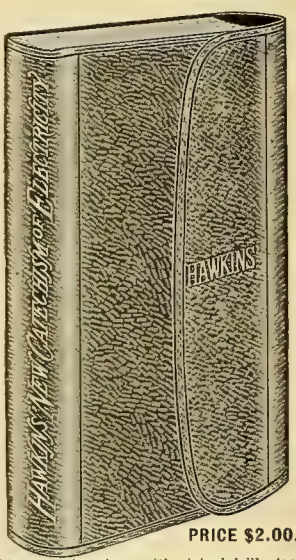

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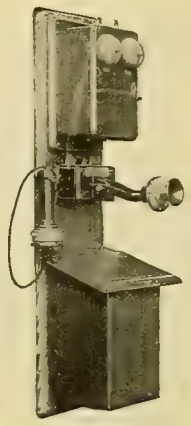

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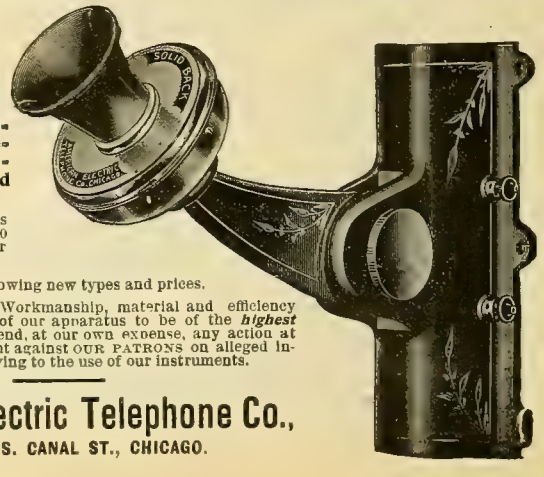

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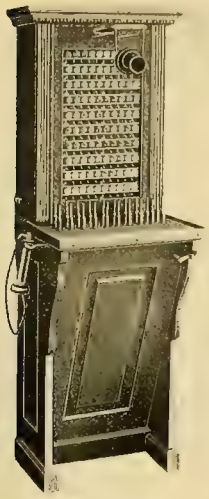

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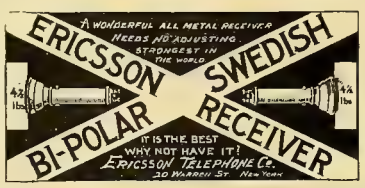

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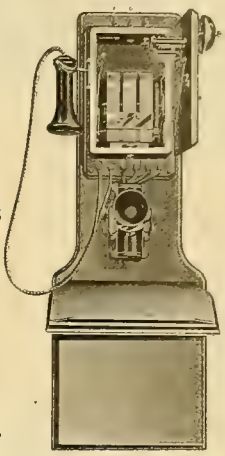

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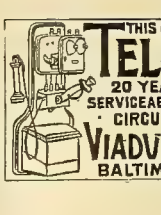

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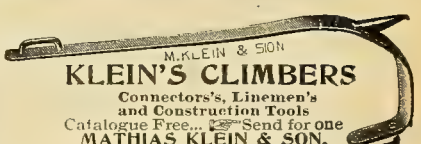

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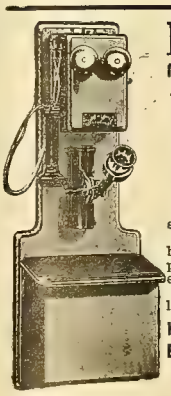

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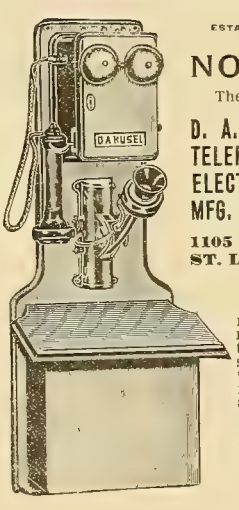

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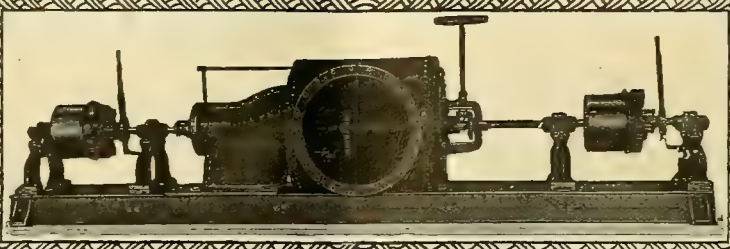

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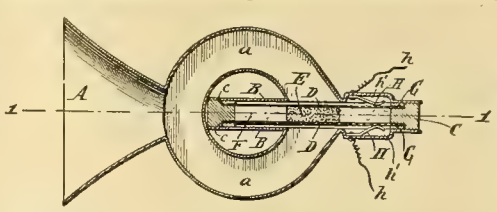

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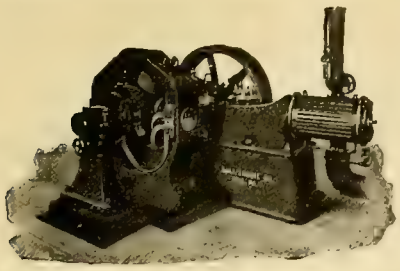

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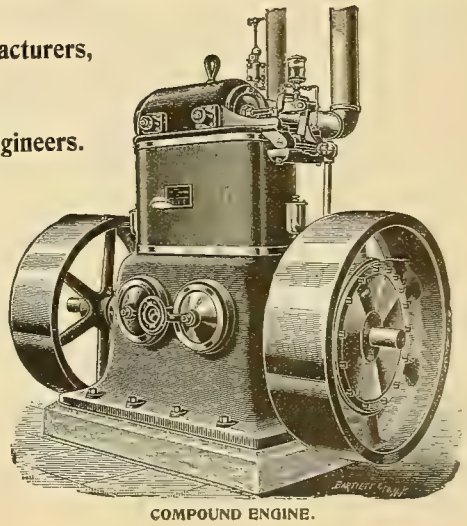

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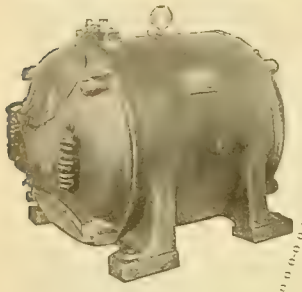

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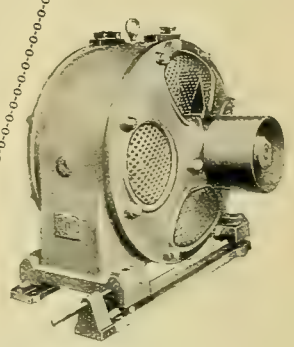

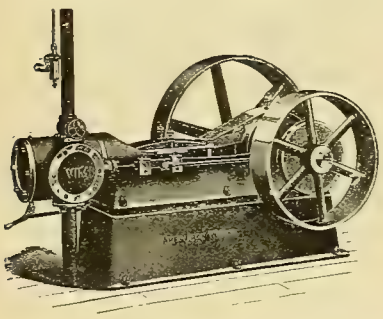

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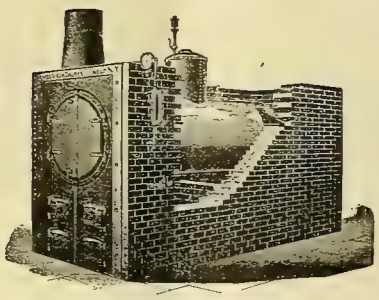

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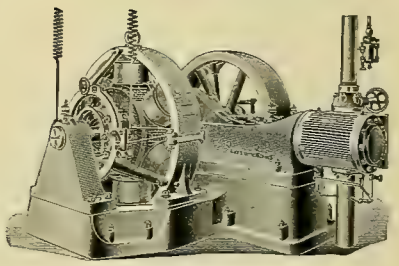

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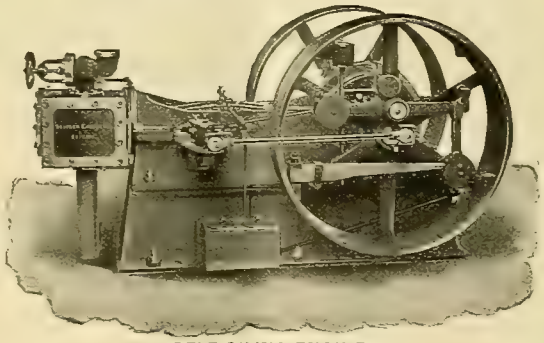

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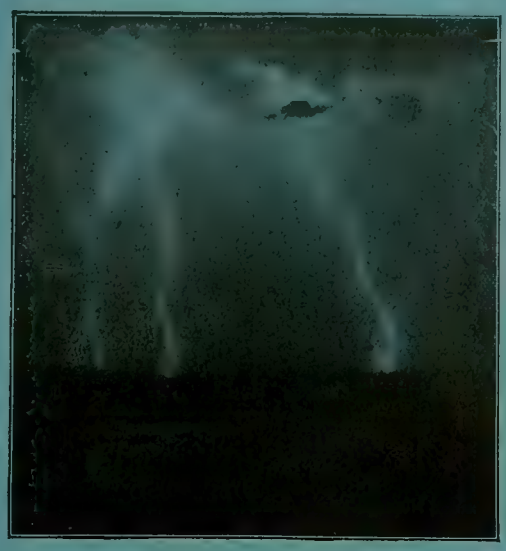

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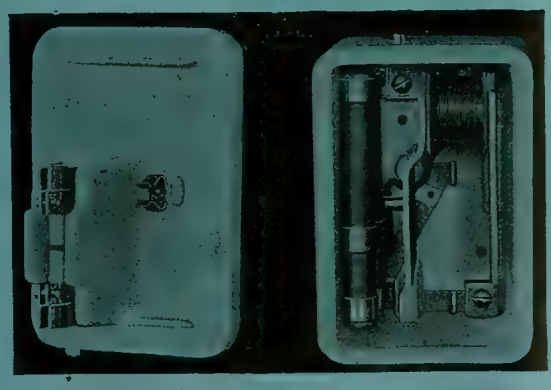

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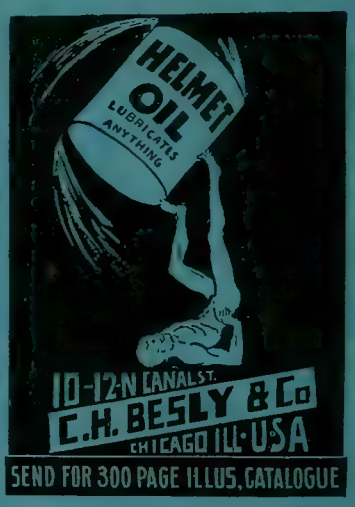

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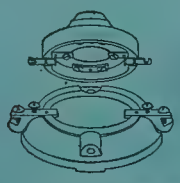

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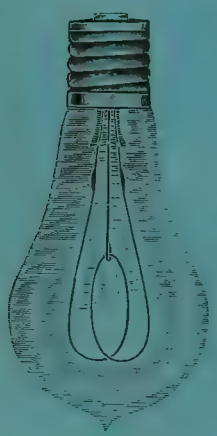

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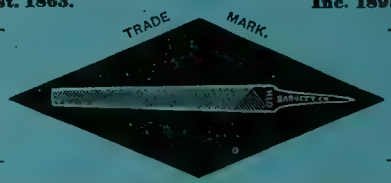

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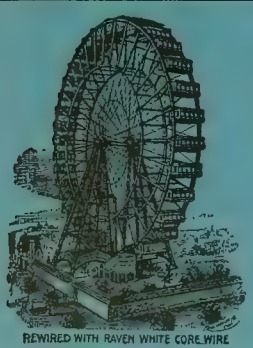
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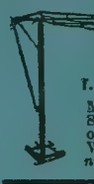

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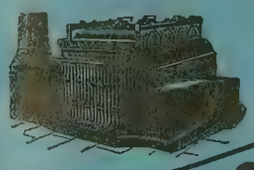

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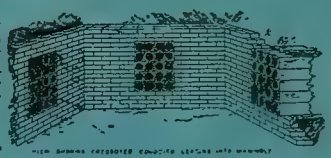

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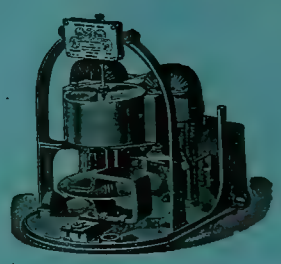

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CLAREMONT ELECTRIC LIGHT COMPANY, CLAREMONT, N. H., June 29, 1898.

GENTLEMEN:—In regard to the storage battery installed by you at our power house, I am pleased to make the following statement:

I have practically had charge of the plant since its installation two years ago. The plates are now in good condition, and no renewals whatever have been made.

In the month of January, 1896, before the batteries were installed, it was found necessary to run the auxiliary engine some 150 hours to supplement the water wheel. During January, 1898, after the batteries were installed, the same conditions as regards water power prevailed, and the station load was 33 per cent heavier, yet it was necessary to run the auxiliary engine only 13 hours during the month.

We have also abandoned entirely the use of the water wheel governor since the batteries were put in, these serving to maintain satisfactory regulation, the hand gate being used to take care of the large and gradual changes of head and load.

During the winter we frequently discharge the battery at the rate of 75 amperes for two hours or more to carry the peak of the lighting load, its nominal rating being 50 amperes. It also carries the load during the day and after midnight without any attendance whatever. [Signed] W. A. HESSELTINE, Supt.

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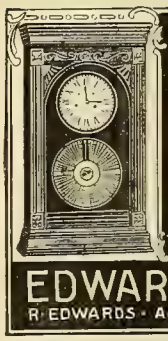

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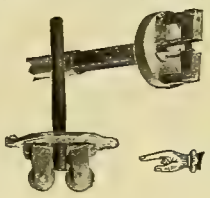

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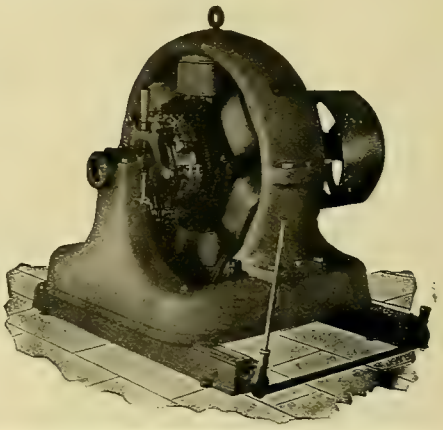

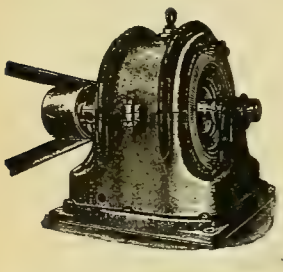

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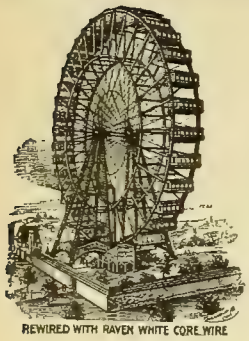

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Bossert Elec. Const. Co.
Leonard, H. Ward Elec. Co.

Lamps, Incandescent.
Beacon Lamp Co.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.,
Illinois Electric Co.
Insull, Martin J.
K. & W. Company.
Lynn Incandescent Lp. Co.
Sawyer-Man Elec. Co.
United Elec. Imp. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Leather.
American Pegamoid Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Magnet Wire.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Link-Belt Machinery Co.
Stilwell-Bierce Smith-Valle.
Westinghouse, Church, Kerr & Co.

Mica.
Central Electric Co.
Commercial El. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.

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Akron Elec. Mfg. Co.
American Engine Co.
Beck, A., Electric Co.
Bullock Elec. Mfg. Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Illinois Electric Co.
Insull, Martin J.
Sargent & Lundy.
Stanley Elec. Mfg. Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

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American Pegamoid Co.
Atlantic Alcatraz Asph. Co.
Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Standard Paint Co.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

Platinum.
Baker & Co.

Poles.
Berthold & Jennings.
Electric Ry. Equipment Co.
Lindsley Bros.
Michigan Pipe Company.
Torrey Cedar Co.

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Central Electric Co.
Commercial El. Supply Co.
Empire China Works.
Peru Elec. Mfg. Co.

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Swarts Metal Refining Co.

Re-Winding—Repairs.
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Chicago Armature Co.
Chicago Edison Co.
Electrical Exchange.
Hodge, Walsh & Loring.

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Cutler-Hammer Mfg. Co.
General Electric Co.
Leonard, Ward, Electric Co.
Ohio Elec. Specialty Mfg. Co.
Westinghouse El. & Mfg. Co.

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Cincinnati Corrugating Co.

Second-Hand Machin'y.
Electrical Exchange.
Hodge, Walsh & Loring.

Speaking Tubes.
Central Electric Co.
Edwards & Co.
Electric Appliance Co.
Illinois Electric Co.
Partrick, Carter & Wilkins.
Western Electric Co.
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Besly & Co., Chas. H.
Keystone El. Instrument Co.
Queen & Co.
Weston Electrical Inst. Co.

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Bossert Elec. Const. Co.

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American Battery Co.
Crofton Storage Battery Co.
Electric Storage Battery Co.
Lockie & Viall.

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Stephenson Co., John.

Tapes, Insulating.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

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Allen-Hussy Co.
American El. Telephone Co.
Cabinet Mfg. Co.
Commercial El. Supply Co.
Ericsson Telephone Co.
Farr Tel. & Cons. Sup. Co.
Fisk, H. M., Mfg. Co.
Holtzer-Cabot Electric Co.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A., Tel. & El. Mfg. Co.
Northwest Engineering Co
Rawson Electric Co.
St. Louis El. Supply Co.
Standard Tel. & El. Co.
Star Dynamo Works.
Sterling Electric Co
Stone City Tel. Mfg. & Cons. Co.
Stromberg-Carlson Tl. M. Co.
Viaduct Mfg. Co.
Victor Telephone Mfg. Co.
Western Electric Co.
Western Elect Supply Co.
Western Tel. Cons. Co.
Wilhelm Tel. Mfg. Co.
Williams Electric Co.

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Klein & Son, Mathias.

Transformers.
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Commercial El. Supply Co.
Diamond Elec. Co.
Ft. Wayne Elec. Corporation.
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Wagner Elec. Mfg. Co.
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Samson Cordage Wks.

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General Electric Co.
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Dayton Globe Iron Works Co
Leffel & Co., Jas.
Pelton Water Wheel Co.
Stilwell-Bierce Smith-Valle

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Vulcanized Fibre Co.

Wire, Bare.
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Brixey, W. R.
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Electric Appliance Co.
Illinois Electric Co.
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Phillips Insulated Wire Co.
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Standard Underground C. Co
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Central Electric Co.
Commercial El. Supply Co
Queen & Co.

Zincs.
Beattie Zinc Works Co.

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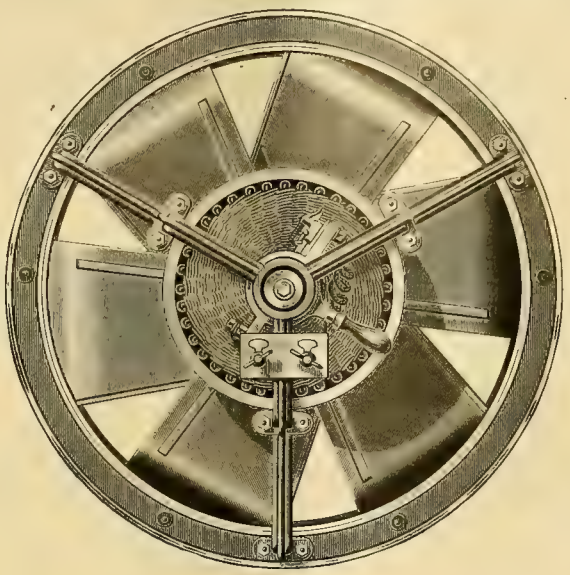
FOR ALL CIRCUITS, EXCEPT ALTERNATING.

For Theatres, Hospitals, Public Buildings, and All Places where Perfect Ventilation is Desired.



Equipped with Fire-Proof Speed Regulator of the Most Improved Type.

All Fans Directly Connected to Motors.

Catalogue Sent Upon Application.

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Main Office and Factory:
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INCANDESCENT LAMPS 12 cents.

Now is the time to get your burned out lamps together and have them renewed or turned into cash. We have now repaired over 700,000 lamps, and nine out of ten of our shipments are to old customers.

We use the same care as regards voltage, candle power, etc., as in making our new lamps.

We are now pleasing central station managers by supplying a uniform and efficient lamp at a price that makes it profitable to replace lamps every 600 hours or oftener.

The renewal of lamps makes this possible.

If you prefer new lamps, we can supply you with the best and allow you three cents each for your burned out lamps.

Lynn Incandescent Lamp Co.,

LYNN, MASS.

Manufacturers and Dealers.

ELECTRICAL SUPPLIES AND APPARATUS.

Arc and Incandescent Lighting Dynamos,
Power Dynamos and Motors,
Arc and Incandescent Lamps,
Switches, Sockets, Cut Outs,
Fan Motors, Telegraph, Testing and Measuring Instruments, Wire, Bells,
Batteries and all Sundries required in An Electrical Installation.

WESTERN ELECTRIC COMPANY,

Manufacturers of Cables, Wires, Telegraph Instruments, Electric Light Apparatus and Supplies,

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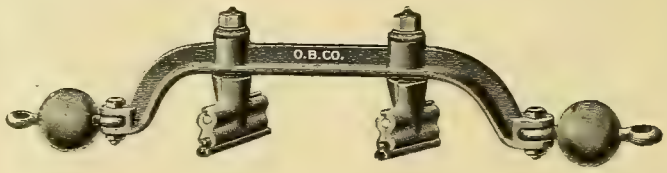
Western Electrical Supply Co.,

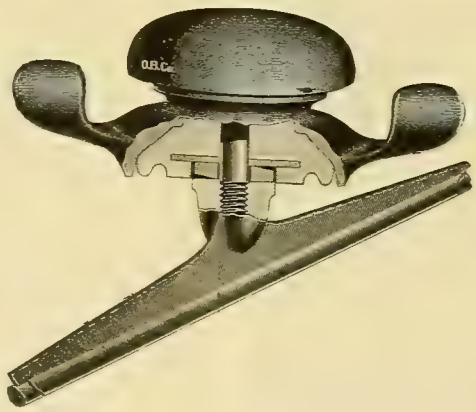
St. Louis, Mo.



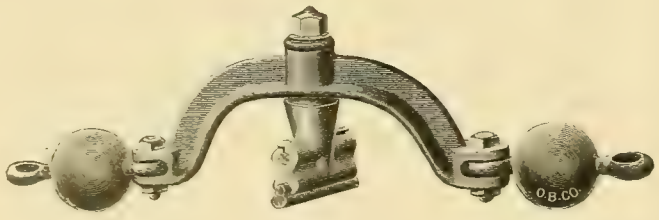
Headquarters

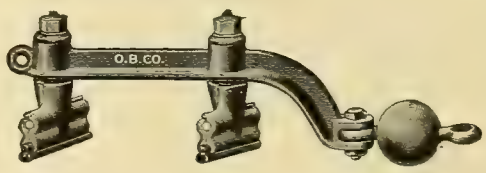
----FOR----

Electric Railway Supplies.



Write Us for Our New No. 16-A Railway Catalogue, Just Out. It is Devoted Exclusively to Electric Railway Supplies and is Strictly Up to Date.



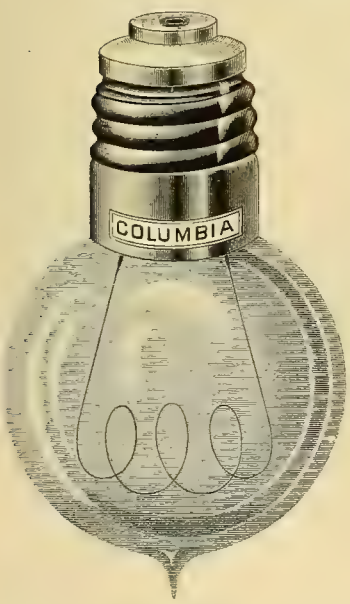


COLUMBIA LAMPS!

UNEQUALED IN QUALITY.

WE PRESENT herewith cut of the Columbia Railway Lamp, made for series burning on electric street railway circuits, and guarantee our Railway Lamps to be absolutely uniform in current consumption, thereby insuring an even distribution of light throughout the car, all lamps burning at same incandescence. This type of lamp is used exclusively by some of the largest street railway systems in this country, and we have yet to receive the first complaint from their service.

A trial order is respectfully solicited, enabling us to demonstrate in actual service the superior qualities of the Columbia Lamp.



The smaller cut represents our special headlight lamp made to burn in series with the other lamps in the car. It will also be found well adapted to decorative lighting in cars for trolley parties.

Lamps in stock at branch offices.

The Columbia Incandescent Lamp Company,

MAIN OFFICE AND FACTORY:

1910, 1912, 1914 OLIVE STREET, ST. LOUIS, MO.

BRANCH OFFICES: New York, 1311 Havemeyer Bldg. Chicago, 1236 Monadnock Bldg. San Francisco, Paul Seiler Electrical Works.

DON'T "BE SWITCHED"

Until you have seen our catalogue of Anchor Switches.

**RIGHT UP TO DATE—
JUST OFF THE PRESS.**

We carry a large stock of these desirable switches and our arrangement with the manufacturers enables us to quote factory prices.

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ELECTRICAL SUPPLIES, 242 MADISON ST., CHICAGO.

Send for Samples and Prices of

SAMSON SPOT CORD

For Arc Light and Trolley Cord.

WATERPROOFED.

SAMSON CORDAGE WORKS, BOSTON, MASS.

American Electrical Heater Company,

MANUFACTURERS OF

ELECTRIC SOLDERING IRONS,

TAILORS' IRONS, LAUNDRY IRONS, HAT IRONS, CURLING IRON HEATERS, ETC. Also other Devices for Electrical Heating.

197 RIVER STREET, DETROIT, MICH.

Automatic Time Switches

FOR CONTROLLING

ELECTRIC LIGHTS and POWER CIRCUITS.

Entirely Automatic and Absolutely Reliable. Also

ARC CUT-OUTS for High Tension Arc Circuits. The BEST APPLIANCES of the Kind are Manufactured by

THE CLEVELAND ELECTRIC CO.,

Corner High and Middle Sts., CLEVELAND, O.

WRITE FOR BULLETINS AND PRICE.

For **UNIONS, HANDHOLES and MANHOLES.**

Fac-simile of a 6-inch section of Eclipse Gasket, showing name and trade-mark imbedded.

PATENTED AND MANUFACTURED EXCLUSIVELY BY

PEERLESS RUBBER MANUFACTURING CO.,

16-24 Woodward Ave., Detroit, Mich. 202-210 S. Water St., Chicago, Ill. 16 Warren St., New York.

Outlet or Junction Boxes.

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BRONXVILLE, N. Y.

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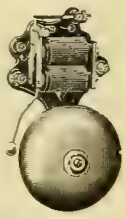
Contractor for Municipal and Isolated Electric Light Plants, Security Bldg., St. Louis.

IRON ARMORED CONDUIT WORK A SPECIALTY.



Best Bell Style F.

KNOWN BY ITS GOOD POINTS.

HUEBEL & MANGER, 286 GRAHAM ST., BROOKLYN, N. Y.

BUY YOUR BOOKS

FROM THE

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Manufacturers' Agent,

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Fort Wayne **INCANDESCENT LAMPS.**

D. & W. **ENCLOSED FUSES** and other specialties. Sole agent.

Gravity Motor Controllers, Sole agent.

Bergmann **SWITCHES** and supplies. Sole agent except for Cook county.

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Consulting Engineer,
Electricity, Mechanics,
Solicitor of Patents

Expert in patent causes.

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AURORA, ILL.,

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Estimates, plans, specifications, superintendence and tests for lighting and power plants. Motor work and electrical equipment for shops and factories a specialty.

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NOVEL FEATURES.

Cheap, Light, Durable, Efficient. Motocycle Batteries a Specialty.

CROFTON STORAGE BATTERY CO.,
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"Ana"
A. C. Motors
Switches
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Switchboards.
Transformers
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Upon receipt of this COUPON we will send free a sample stick of

Gale's Commutator Compound

50 Cents Per Stick. **$5.00 Per Dozen.**

The only article that will prevent sparking. Will keep the commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

It will put that HIGH GLOSS on THE COMMUTATOR you have so long sought after.

FOR SALE BY ALL SUPPLY HOUSES, OR

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K. McLENNAN & CO.,

Sole Manufacturers,

100 Washington Street, CHICAGO.

Fort Wayne Electric Corporation,

FORT WAYNE, IND.

Apparatus for

Arc, Direct Current and Alternating Incandescent Lighting and Power Transmission.

INDIA & AMBER **MICA** IN ANY SHAPE OR PATTERN.

FOR ARMATURE COILS AND FIELDS.

EMPIRE INSULATED Cloths and Papers.

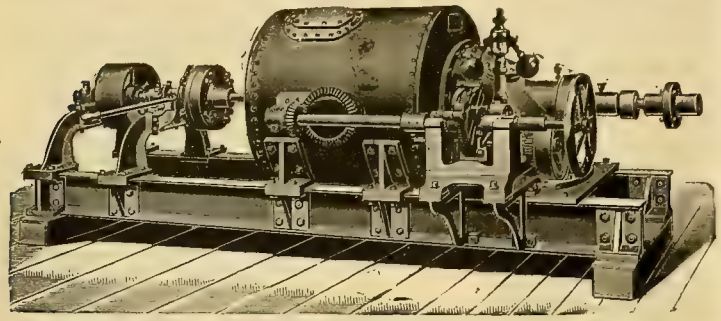
M·I·C· COMPOUND UNEQUALED.

PERFECT **MICANITE** INSULATOR REGISTERED.

Eugene Munsell & Co. 218 Water St. New York & Mica Insulator Co. Chicago. 117 Lake St.

WRITE FOR SAMPLES AND PRICES.

Victor Turbine Water Wheel.



Cylinder or Register Gate Close Regulation and High Efficiency at Full and Partial Gate.

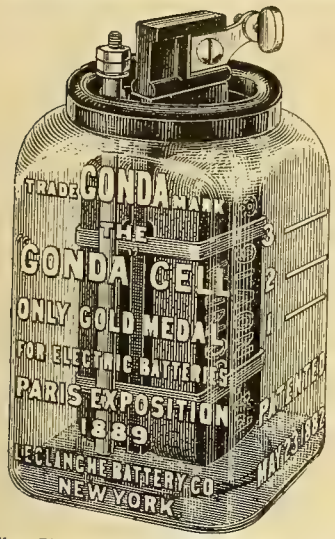
The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

SEND FOR CATALOGUE AND PARTICULARS.

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs on horizontal shafts and where the situation admits of their use we recommend them.

THE STILWELL-BIERCE & SMITH-VAILE CO., DAYTON, OHIO.



The Standard Open Circuit Batteries of the World.

SEND FOR CIRCULAR AND PRICES.

THE LECLANCHÉ BATTERY CO.,
111 to 117 East 131st St., N. Y.

PERHAPS YOU HAVE HEARD

Of a railway system running between Chicago, Milwaukee, St. Paul, Minneapolis, Ashland and Duluth, known as the Wisconsin Central Lines. Before making a journey to any of these northwestern points, inquire relative to the fast and elegantly equipped trains which leave Chicago daily via the Wisconsin Central. Your nearest ticket agent can give you complete information.
JAS. C. POND, G. P. A., Milwaukee, Wis.

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See a copy of our latest catalogue of Electrical Books? 100 pages, mailed free.

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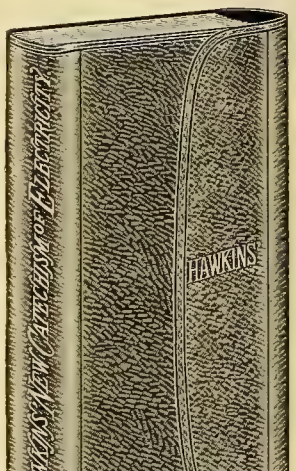
CEDAR LINDSLEY BROS., MENOMINEE, MICH. POLES
WHOLESALE PRODUCERS.

Cedar TORREY CEDAR CO., CLINTONVILLE, WIS. Poles
Large Stock Constantly on Hand.

POLES AND CROSSARMS
BERTHOLD & JENNINGS,
CHEMICAL BUILDING, ST. LOUIS.

HAWKINS' NEW CATECHISM OF ELECTRICITY.

Plan of the Work, Contents, Etc.



PRICE $2.00.

The New Catechism of Electricity will be found to be surprisingly plain, and free from useless and ambiguous terms. The plan upon which it is arranged is unique.

The book is, first of all, intended to be plain and instructive; some 300 illustrations have been introduced, so that the mere pictures will afford almost a knowledge of the subjects.

It is a school book from the manner in which it proceeds from the simple facts to the abstract principles which the facts indicate; it is also a book of reference through the index of seventeen double columns of fine type pages; by means of this index a thousand items of practical importance are at once available.

It is an up-to date work, which has cost a large outlay of capital and time, and, in short, it is doubtful if any more attractive book has ever been issued—or one more useful.

The subjects treated upon are as follows: Dedication to Thomas A. Edison, with engraving of Mr. Edison; Preface and Introduction; Nature and Source of Electricity and Magnetism.

The Dynamo; Conductors and Non-Conductors; Symbols, abbreviations and definitions relating to electricity; Parts of the Dynamo; The Motor; The Care and Management of the Dynamo and Motor.

Electric Lighting; Wiring; The rules and requirements of the National Board of Underwriters in full; Electrical Measurements.

The Electric Railway; Line Work; Instruction and Cautions for Linemen and the Dynamo Room; Storage Batteries; Care and Management of the Street Car Motor; Electro Plating.

The Telephone and Telegraph; The Electric Elevator; Accidents and Emergencies, etc., etc.

The full one-third part of the whole work has been devoted to the explanation and illustrations of the dynamo, and particular directions relating to its care and management;—all the directions are given in the simplest and most kindly way to assist rather than confuse the learner. The names of the various parts of the machine are also given with pictorial illustrations of the same.

In the Catechism no less than 25 full page illustrations have been given of the various dynamo machines made in different parts of the country, and an equal number of part page illustrations.

ELECTRICIAN PUBLISHING CO., 510 Marquette Bldg., CHICAGO.

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When the World's Fair at Chicago ceased to exist, it was supposed that we should ne'er look upon its like again. However, the Trans-Mississippi Exposition at Omaha has effectively reproduced in similarity all of the buildings which made the White City so attractive in 1893.

It does not now take two weeks to wander through grounds and structures and then be compelled to go away with a jumble of ideas, for the Omaha Exposition people have profited by past experience, and have so improved the arrangement of exhibits that no more than two or three days of time need be consumed in admiration and inspection of the marvelous resources of the West, collected together in the chief city of Nebraska.

Even the new Midway is a reproduction of the far-famed Street of All Nations of 1893, with many improvements upon the original.

The electric lighting of the buildings, grounds and lagoons at night makes a scene of enchanting beauty, alone worth traveling a thousand miles to see.

The means of communication between the city and grounds are ample, and the distance to be traversed is short.

The ways of reaching Omaha are innumerable, but chief among them is the direct Chicago and Omaha short line of the Chicago, Milwaukee & St. Paul Railway, with its electric lighted, vestibuled trains, leaving Chicago every night at 6:15 p. m., and arriving Omaha at 8:20 the next morning. Dining car service en route.

Excursion tickets are on sale at every coupon ticket office in the United States over the Chicago, Milwaukee & St. Paul Railway through Northern Illinois and Central Iowa, as well as at 95 Adams street, and at the Union Passenger Station, Canal and Adams streets, Chicago.

BULLOCK MOTORS!

THE BULLOCK ELECTRIC MFG. CO., CINCINNATI, O.

BULLOCK GENERATORS!

THE BULLOCK ELECTRIC MFG. CO., CINCINNATI, O.

The Most Reliable General Telephone Apparatus Manufacturers in the World.

THE VICTOR TELEPHONE APPARATUS

STANDS FOR

The highest efficiency; and excellence in workmanship, material and finish. We guarantee our devices to be non-infringing and we will protect you against any valid claims of any person or corporation whatsoever.

The Victor Straight Metallic Express Switchboard contains many points of merit long sought for by the independent field. It is the result of fifteen years' experience, coupled with up-to-date developments of switchboard parts. It is the ideal straight metallic circuit; equally adapted for common return or ground, without change. It combines fewness, simplicity and stability of parts, compactness, ease and rapidity of operation, durability and economy of maintenance under the most severe service. This board has no useless trappings or superficial parts. It is built up in five jack and drop sections, invisibly wired, each complete within itself and all accessible without disturbing the surrounding parts.

We manufacture all types and styles of telephones, our standard instruments are equipped with Victor special double pole receiver, long-distance arm transmitter with metal box base, containing 500 ohm induction coil, also our powerful generator and ringer. These appliances taken together give clear and highly efficient service.

We manufacture everything in central station apparatus, telephones and parts, switchboards any capacity, cable heads, cross connection boards, fuse heads, carbon lightning arresters, telephones for long-distance and exchange work, factory and private lines, desk 'phones, double and single pole receivers, arm transmitters, generators, extension bells, etc.

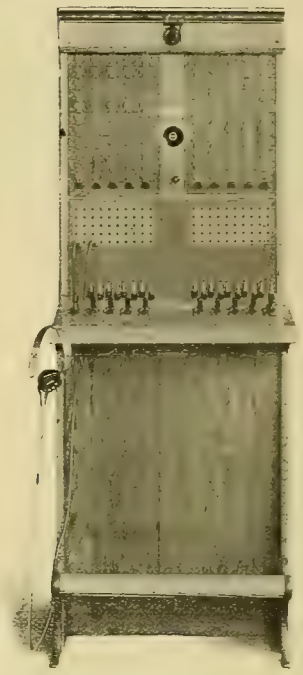
All our products are of the highest quality, our prices are most reasonable and our apparatus contains the finest workmanship, material, and finish. You are wanting from time to time parts, appliances, telephone and central station equipment. Let us know your needs and we will be pleased to submit you full information and make you prices.

The Victor Telephone Mfg. Co.,

166-174 S. CLINTON ST., CHICAGO, ILL.

SWITCHBOARDS

Similar to the Bell for Independent Telephone Companies.



100 DROP.

Distributing Boards, Cable Terminals and Protective Devices the same as those used by the Bell company.

STERLING ELECTRIC CO.,

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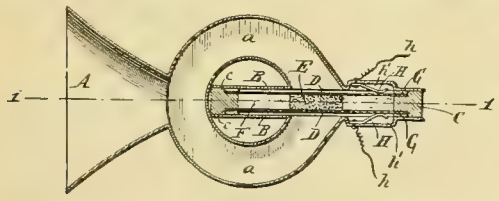
THE DOUBLE DIAPHRAGM

of the **Wilhelm Transmitter** secures a double compression of the carbon granules in the pocket between them, greatly increasing the volume, distinctness and carrying value of the voice. Will not "pack" under any circumstance, and cannot be injured by rough handling or pencil jabbing.



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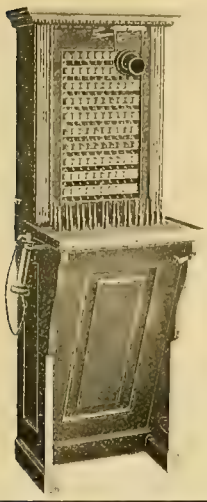

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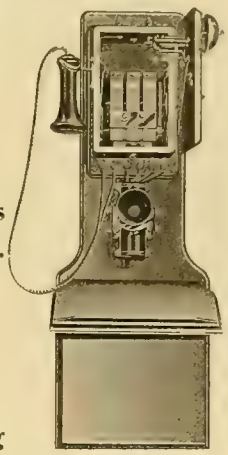

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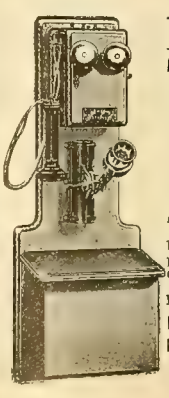

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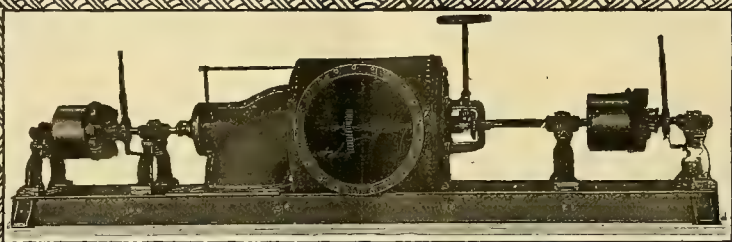

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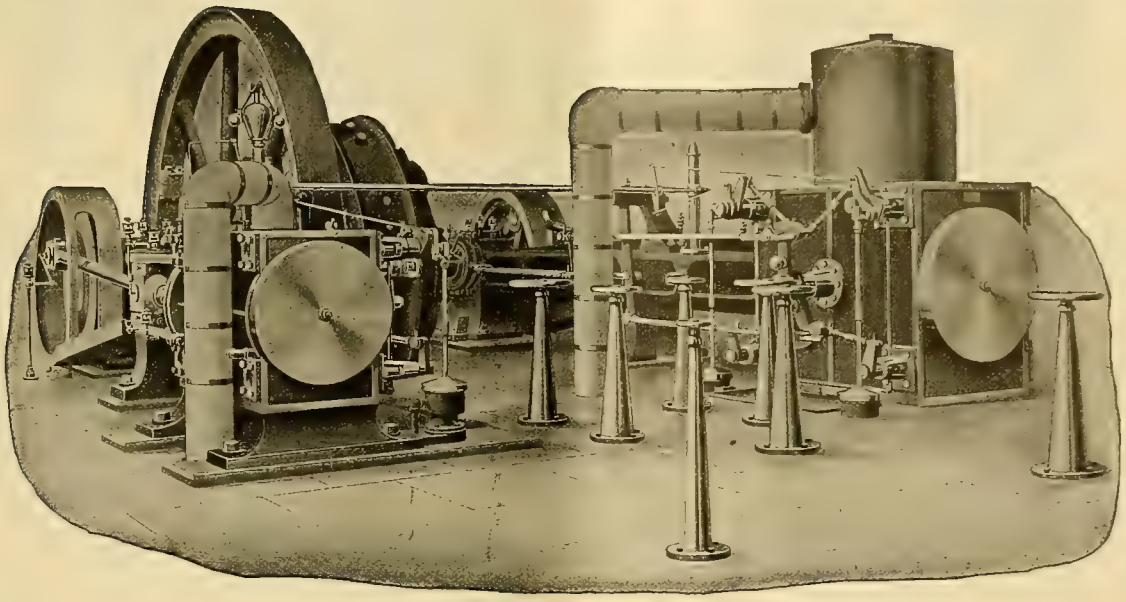

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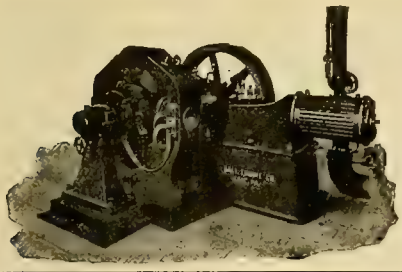

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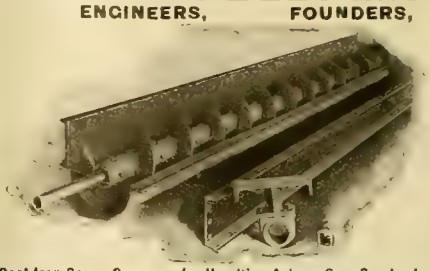

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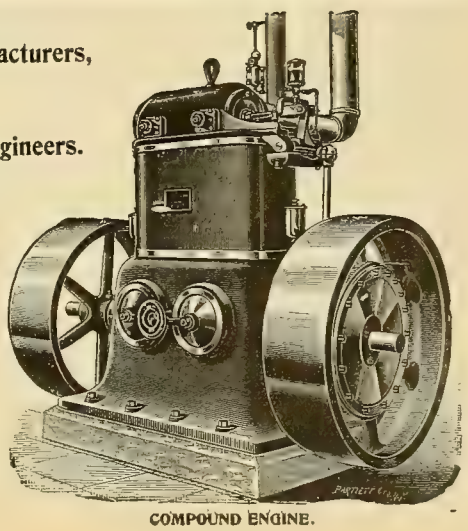

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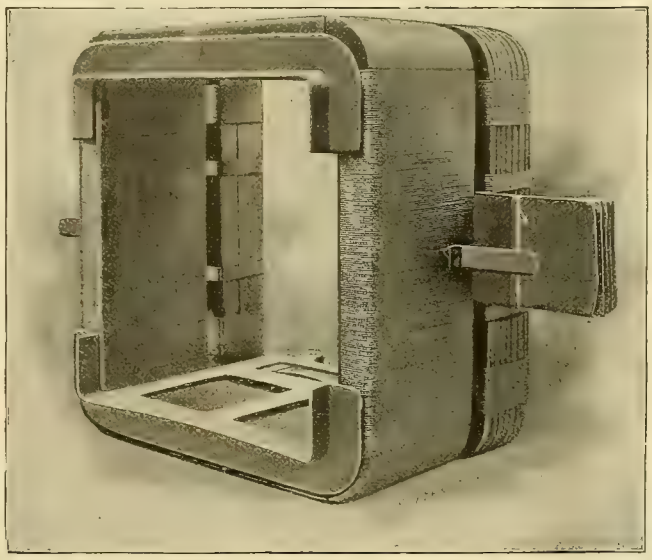

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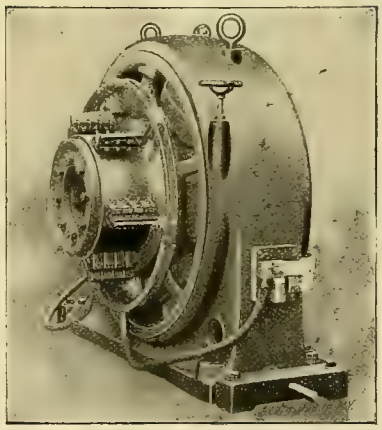

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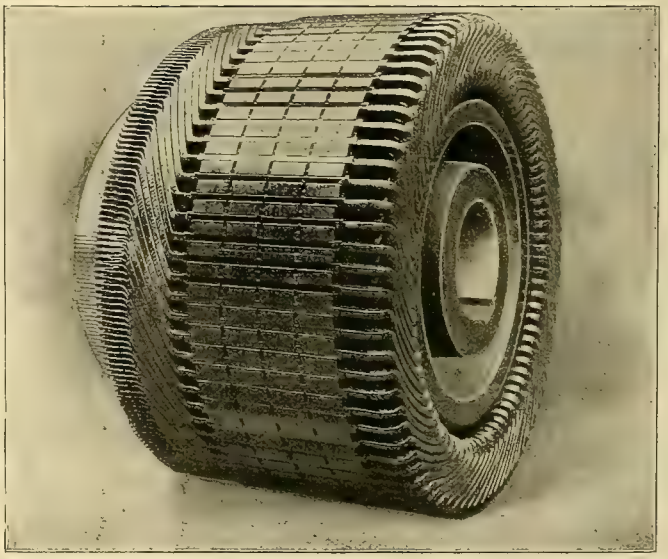

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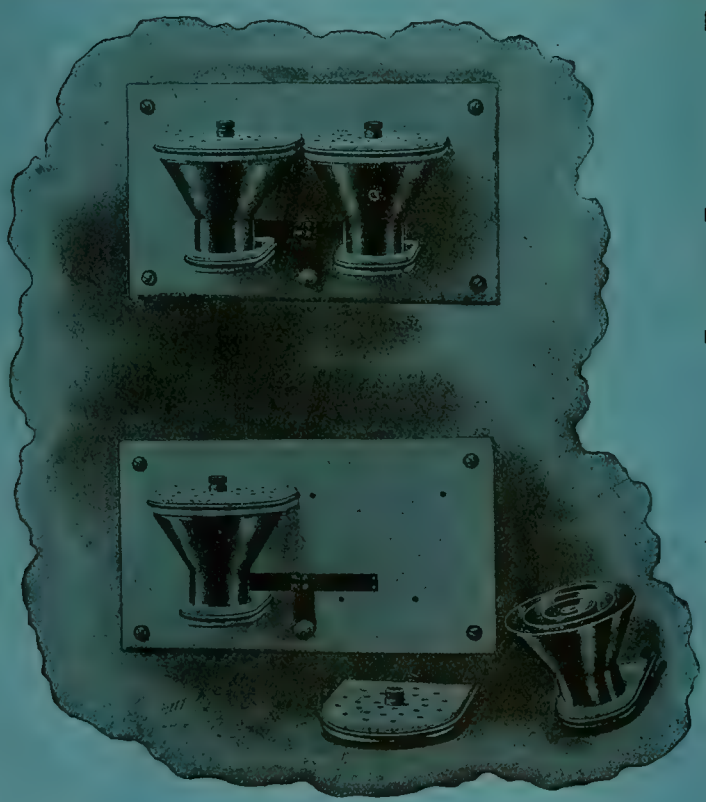

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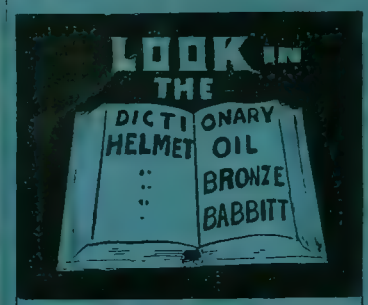

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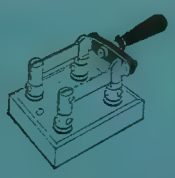

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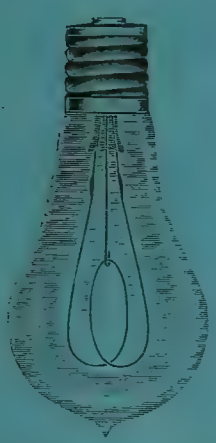

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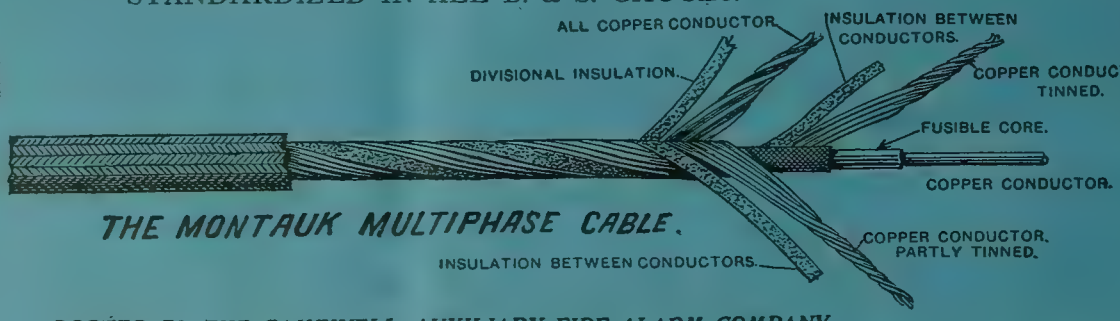

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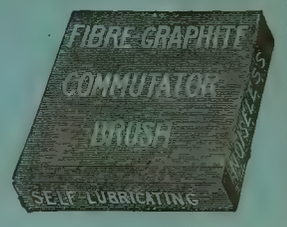

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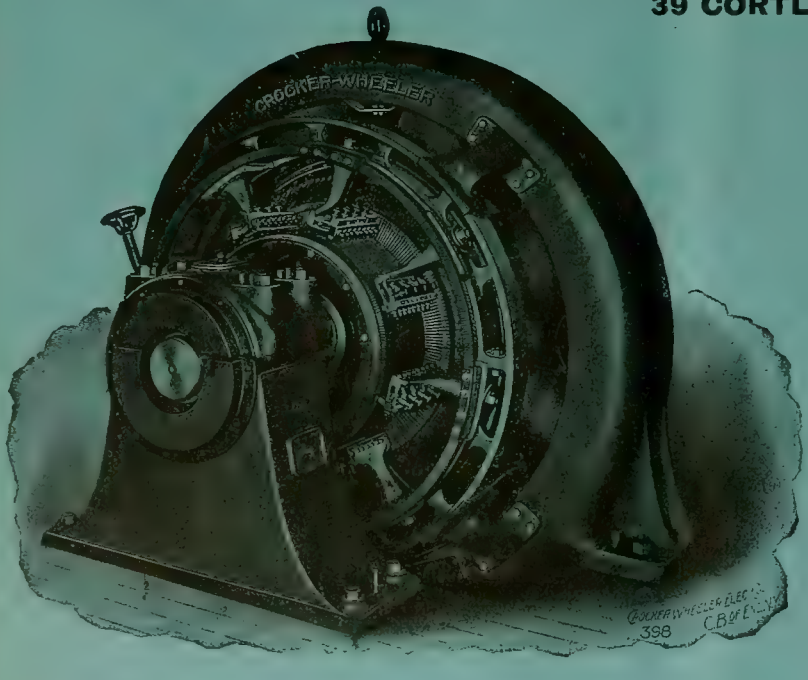

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F. HARDTMUTH & CO., VIENNA, AUSTRIA.

We having received a very large shipment of

CORED CARBONS

Just before the new tariff went into effect, are prepared to make very low prices on the following sizes: 5-8 in. by 10 in. and 12 in. and 19-32 in. by 9 1-2 in.

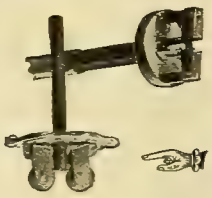
Chicago Edison Company,

General Western Agents, 139 Adams Street, Chicago.

Crain's **PARHELION**

ENCLOSED ARC LAMP.

SEE THAT CLUTCH?



Economical, Simple, Durable,

All Parts Interchangeable.

EVERY LAMP GUARANTEED FOR ONE YEAR.

Write for Prices before placing orders.

Liberal discounts to the trade.

RESPONSIBLE SALES AGENTS WANTED.

GEO. H. STOUT, Gen. Sales Agent,
1208 SHEFFIELD AVE., CHICAGO.

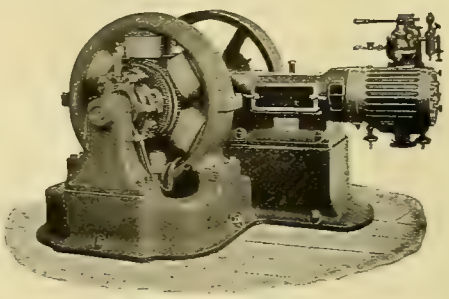
THE AKRON ELECTRICAL MFG. CO.,

AKRON, OHIO.

MAKES

Generators,
Motors,
Direct-Connected,
Slow Speed,
Moderate Speed,
Mining Locomotives.

All of the highest efficiency, most modern construction and most graceful design.



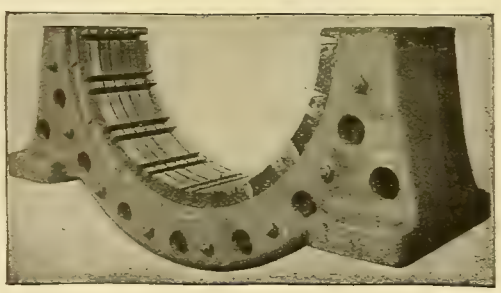
WRITE FOR CIRCULARS AND READ OUR GUARANTEE.

WALKER COMPANY,

ELECTRIC MACHINERY.

Alternating Current Generators

FOR ALL PURPOSES.

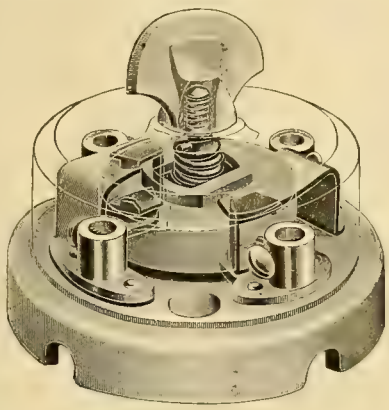


CONSTRUCTION OF ARMATURE.

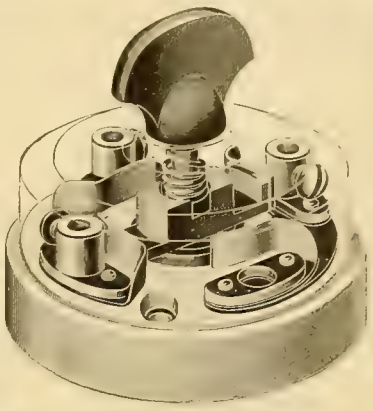
FIELD MAGNET SPIDERS.

Single, Two, or Three Phase—40 or 60 Cycles, Stationary Armature, Revolving Field.

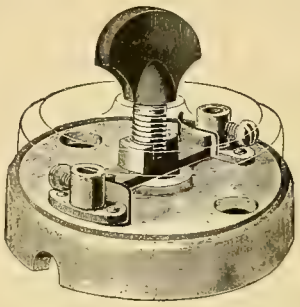
CLEVELAND, OHIO. **NEW HAVEN, CONN.**



PERKIN'S SWITCHES.



ALL KINDS.



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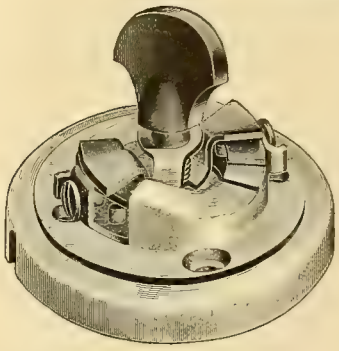
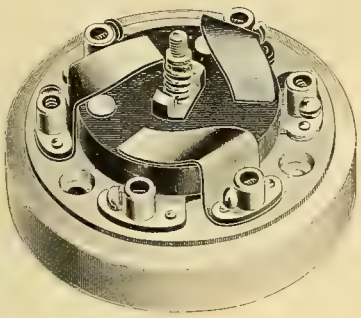
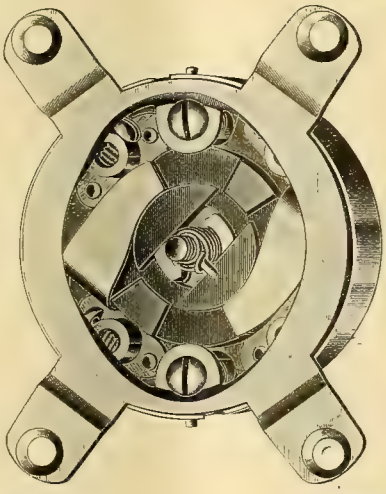
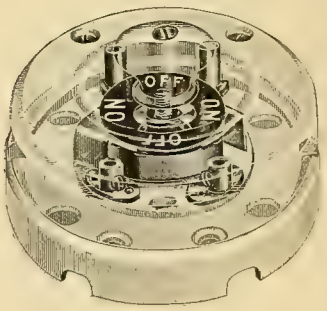


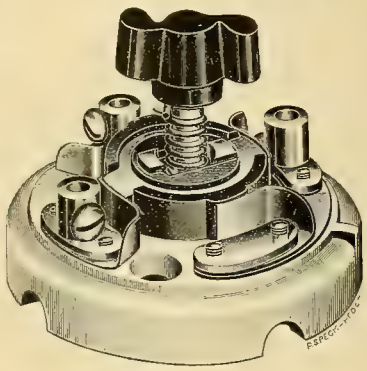
ALL STYLES.



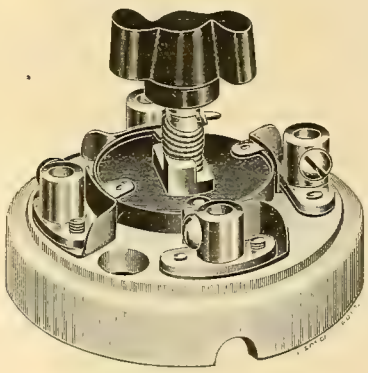




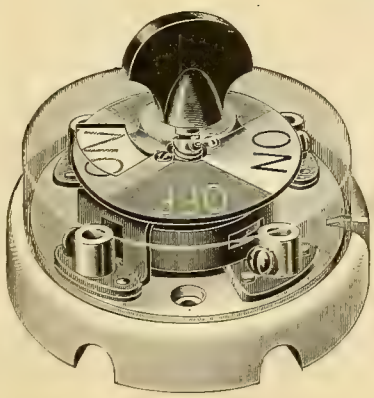
CARRIED



IN



CHICAGO.



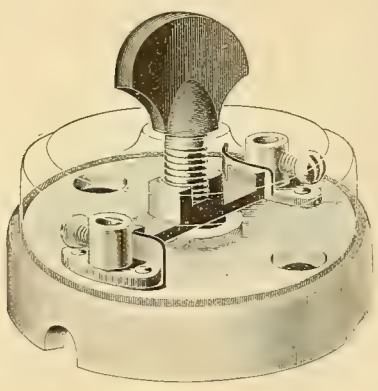
Central Electric Company,

264-266-268-270 Fifth Avenue, Chicago.

GEO. A. McKINLOCK, President.
CHARLES E. BROWN, Secretary.
S. R. FRAZIER, Treasurer.

OKONITE IT NEVER DISAPPOINTS

SOUTHERN ELECTRICAL SUPPLY CO., ST. LOUIS.



COLUMBIA CARBONS

For Enclosed Arcs.

As COLUMBIA is the gem of the ocean, so is the "COLUMBIA" the gem of Enclosed Arc Carbons.

MANUFACTURED BY

THE NATIONAL CARBON CO.

600 HIGHLAND AVENUE, - - - - CLEVELAND, OHIO.

CLASSIFIED INDEX OF ADVERTISEMENTS.

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Commercial El. Supply Co.
Edwards & Co.
Electric Appliance Co.
Illinois Electric Co.
Partrick, Carter & Wilkins
Proctor-Raymond Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.

Arc Lamps.
Central Electric Co.
Diehl Mfg Co.
Electrical Exchange.
Ft. Wayne Elec. Corporation.
General Electric Co.
Gen'l Inc. Arc Light Co.
Lea Mfg. Co.
Stout, G. H.
Walker Company.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Arc Light Cord.
Leschen-Macomber-Whyte Co.
Samson Cordage Wks.

Batteries and Jars.
Burnley Batt. & Mfg. Co.
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Electric Appliance Co.
Gordon Battery Co.
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Commercial El. Supply Co.
Edwards & Co.
Electric Appliance Co.
Huebel & Manger.
Illinois Electric Co.
Partrick, Carter & Wilkins.
Proctor-Raymond Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

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Link Belt Machinery Co.
L. P. & D. Transmitter Co.
Main Belting Co
Munson, Chas. Belting Co.
Peerless Rubber Mfg. Co.
Shultz Belting Co.

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Bridges, Floors, Cranes.
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Holmes Fibre-Graphite Co.
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Berlin Iron Bridge Co.

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Commercial El. Supply Co.
Edwards & Co.
Electric Appliance Co.
Huebel & Manger.
Partrick, Carter & Wilkins.
Western Elect. Supply Co.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
General Electric Co.
Illinois Electric Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Western Elect. Supply Co.

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Commercial El. Supply Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Western Elect. Supply Co.

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Illinois Electric Co.
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McLennan & Co., K.
Ohio Elec. Specialty Mfg. Co.
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Western Electric Co.
Western Elect. Supply Co.

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Electric Appliance Co.
Michigan Pipe Co.
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Bullock Elec. Mfg. Co.
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Ft. Wayne Elec. Corporation.
Hodge, Walsh & Loring.
McRae, A. L.
Sargent & Lundy.
Wagner Elec. Mfg. Co.
Walker Company.
Western Electric Co.
Western Elect. Supply Co.

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Bain, Foree.
Broughton, H. P.
Bullock Elec. Mfg. Co.
Central Electric Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Sargent & Lundy.
Star Dynamo Works.
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Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse Elec & Mfg Co.

Conveyors.
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Copper.
Beattie Zinc Works Co.
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Mansfield Temp. Copper Co.

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Besly & Co., Chas H.
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Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.
Illinois Electric Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons. Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Western Elect. Supply Co.

Cordage.
Samson Cordage Wks

Correspondence Schools.
Elec. Engineer Corr. Inst.
Int. Correspond. Schools.

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Brady, T. H.
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Electric Appliance Co.
Electric Ry. Equipment Co.
Farr Tel. & Cons. Sup. Co.
Michigan Pipe Co.
Western Elect. Supply Co.

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Edwards & Co.
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Emerson El. Mfg. Co.
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Illinois Electric Co.
Insull, Martin J.
K. & W. Company.
Leonard, H. Ward Elec. Co.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Bullock Elec. Mfg. Co.
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Commercial El. Supply Co.
Crocker-Wheeler Elec. Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Insull, Martin J.
Sargent & Lundy.
Star Dynamo Works.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warner Co., Wm. F.
Warren Elec. Mfg. Co.
Warren-Medbery Co.
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Westinghouse El. & Mfg. Co.

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Fuel Economizer Co.

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American Elec. Heater Co.

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American El. Meter Co.

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General Electric Co.
Walker Company.
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Broughton, H. P.
Lemon, L. E.
Sargent & Lundy.

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Cutter El. & Mfg. Co.
Electric Appliance Co.
General Electric Co.
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Illinois Electric Co.
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Leonard, Ward, Elec. Co.
Paiste Co., H. T.
Queen & Co.
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General Electric Co.
Hobart Elec. Mfg. Co.

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Otto Gas Engine Wks.

Engines, Steam.
Ames Iron Works.
Armington & Sims Co.
Ball Engine Co.
Skinner Engine Co.
Westinghouse, Church, Kerr & Co.

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Diehl Mfg. Co.
Emerson El. Mfg. Co.
General Electric Co.
Illinois Electric Co.
Rosenberg, Co., A.
St. Louis El. Supply Co.
Wagner Electric Mfg. Co.
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Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Commercial El. Supply Co.
Western Elect. Supply Co.

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Stow Mfg. Co.

Fuses.
Insull, Martin J.

Fuse Wire.
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Electric Appliance Co.
Western Elect. Supply Co.

Gaskets.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

Gas Lighting, Electric.
Central Electric Co.
Partrick, Carter & Wilkins.
Western Electric Co.

Gears.
Besly & Co., Chas. H.
Link-Belt Machinery Co.

General Elec. Supplies.
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Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.
Hill, W. S. Electric Co.
Illinois Electric Co.
Insull, Martin J.
Partrick, Carter & Wilkins.
Peru Elec. Mfg. Co.
St. Louis El. Supply Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Central Electric Co.
Commercial El. Supply Co.
Western Elect. Supply Co.

Gov'nors, Water Wheel.
Lombard Water Wheel Gv. Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Insulators and Insulating Materials.
Atlantic Alcatraz Asph. Co.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Delaware Hard Fibre Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Empire China Works.
Hill, W. S. Electric Co.
Illinois Electric Co.
Kartavert Mfg. Co.
Mass. Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.

Insulated Wires and Cables—Magnet Wires.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Eastern Electric Cable Co.
Electric Appliance Co.
General Electric Co.
Leschen-Macomber-Whyte Co.
Montauk Multiph. Cable Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Washburn & Moen Mfg. Co.
Western Elect. Supply Co.

Junction Boxes.
Bossert Elec. Const. Co.
Leonard, H. Ward Elec. Co.

Lamps, Incandescent.
Beacon Lamp Co.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Commercial El. Supply Co.
Electric Appliance Co.
General Electric Co.,
Illinois Electric Co.
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Lynn Incandescent Lp. Co.
Sawyer-Man Elec. Co.
United Elec. Imp. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Leather.
American Pegamoid Co.

Lightning Arresters.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

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(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Link-Belt Machinery Co.
Stilwell-Bierce Smith-Valle.
Westinghouse, Church, Kerr & Co.

Mica.
Central Electric Co.
Commercial El. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
General Electric Co.
Link-Belt Machinery Co.
Westinghouse El. & Mfg. Co.

Motors.
Akron Elec. Mfg. Co.
American Engine Co.
Beck, A., Electric Co.
Bullock Elec. Mfg. Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Illinois Electric Co.
Insull, Martin J.
Sargent & Lundy.
Stanley Elec. Mfg. Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Packing.
Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

Paints.
American Pegamoid Co.
Atlantic Alcatraz Asph. Co.
Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Standard Paint Co.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.

Platinum.
Baker & Co.

Poles.
Berthold & Jennings.
Electric Ry. Equipment Co.
Lindsley Bros.
Michigan Pipe Company.
Torrey Cedar Co.

Porcelain.
Central Electric Co.
Commercial El. Supply Co.
Empire China Works.
Peru Elec. Mfg. Co.

Refiners.
Swarts Metal Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.

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Chicago Armature Co.
Chicago Edison Co.
Electrical Exchange.
Hodge, Walsh & Loring.

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Cutler-Hammer Mfg. Co.
General Electric Co.
Leonard, Ward, Electric Co.
Ohio Elec. Specialty Mfg. Co.
Westinghouse El. & Mfg. Co.

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Electrical Exchange.
Hodge, Walsh & Loring.

Shades.
Amer. Reflector & Ltg. Co.

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Edwards & Co.
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Illinois Electric Co.
Partrick, Carter & Wilkins.
Western Electric Co.
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Speed Indicators.
Besly & Co., Chas. H.
Keystone Sl. Instrument Co.
Queen & Co.
Weston Electrical Inst. Co.

Steel Boxes.
Bossert Elec. Const. Co.

Storage Batteries.
American Battery Co.
Crofton Storage Battery Co.
Electric Storage Battery Co.
Lockie & Viall.

Street Cars.
Stephenson Co., John.

Tapes, Insulating.
American Electrical Works.
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Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Leschen-Macomber-Whyte Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Telephones, Telephone Material and Switchboards.
Allen-Hussy Co.
American El. Telephone Co.
Cabinet Mfg. Co.
Commercial El. Supply Co.
Ericsson Telephone Co.
Farr Tel. & Cons. Sup. Co.
Fisk, H. M., Mfg. Co.
Holtzer-Cabot Electric Co.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co
Northwest Engineering Co
Rawson Electric Co.
St. Louis El. Supply Co.
Standard Tel. & El. Co.
Star Dynamo Works.
Sterling Electric Co.
Stone City Tel. Mfg. & Cons. Co.
Stromberg-Carlson Tl. M. Co.
Viaduct Mfg. Co.
Victor Telephone Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Western Tel. Cons. Co.
Wilhelm Tel. Mfg. Co.
Williams Electric Co.

Tools.
Klein & Son, Mathias.

Transformers.
Central Electric Co.
Commercial El. Supply Co.
Diamond Elec. Co.
Ft. Wayne Elec. Corporation
General Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Walker Company.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co

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Samson Cordage Wks.

Trucks, Electric Car.
General Electric Co.
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Turbine & Water Wheels.
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Pelton Water Wheel Co.
Stilwell-Bierce Smith-Valle

Vulcanized Fibre.
Vulcanized Fibre Co.

Wire, Bare.
Besly & Co., Chas. H.
Brixey, W. R.
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Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Leschen-Macomber-Whyte Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Washburn & Moen Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Woodwork, Electrical.
Cabinet Mfg. Co.

X Ray Outfits.
Central Electric Co.
Commercial El. Supply Co.
Queen & Co.

Zincs.
Beattie Zinc Works Co.

For Alphabetical Index of Advertisements See Page III.

All genuine "ELECTRA" Carbons are put up in packages bearing a label with the TRADE MARK "ELECTRA."

Infringers of my trade-mark will be rigidly prosecuted to protect the interest of purchasers of my carbons.

Notice—The "ELECTRA" Highest Grade Nuernberg Carbons are, as heretofore, manufactured for me by the world-renowned firm of **C. Conradty, of Nuernberg,** who owns both the oldest as well as the **largest carbon works in existence,** and whose carbons are recognized as the standard all the world over.

The Best System of Belting in the World

The C. L. P. & D. Transmitter Co.
MONTPELIER, VT.

Compared with Straight Belts - - { Easier on bearings, Smaller per cent. of slip, One-half the space.

Compared with Clutches - - - - { Less expense, More efficient in operation, Great saving in space.

Compared with Direct Coupling - { About the same floor space, Cost much smaller, Easier to keep in repair.

Write for Further Particulars.

INCANDESCENT LAMPS 12 cents.

Now is the time to get your burned out lamps together and have them renewed or turned into cash. We have now repaired over 700,000 lamps, and nine out of ten of our shipments are to old customers.

We use the same care as regards voltage, candle power, etc., as in making our new lamps.

We are now pleasing central station managers by supplying a uniform and efficient lamp at a price that makes it profitable to replace lamps every 600 hours or oftener.

The renewal of lamps makes this possible.

If you prefer new lamps, we can supply you with the best and allow you three cents each for your burned out lamps.

Lynn Incandescent Lamp Co.,
LYNN, MASS.

Manufacturers and Dealers.

ELECTRICAL SUPPLIES AND APPARATUS.

Arc and Incandescent Lighting Dynamos,
Power Dynamos and Motors,
Arc and Incandescent Lamps,
Switches, Sockets, Cut Outs,
Fan Motors, Telegraph, Testing and Measuring Instruments, Wire, Bells,
Batteries and all Sundries required in An Electrical Installation.

WESTERN ELECTRIC COMPANY,

Manufacturers of Cables, Wires, Telegraph Instruments, Electric Light Apparatus and Supplies,

CHICAGO. NEW YORK.

LONDON. 79 Coleman Street. ANTWERP. 33 Rue Boudewyns. PARIS. 45 Avenue de Breteuil.

SAWYER-MAN LAMPS

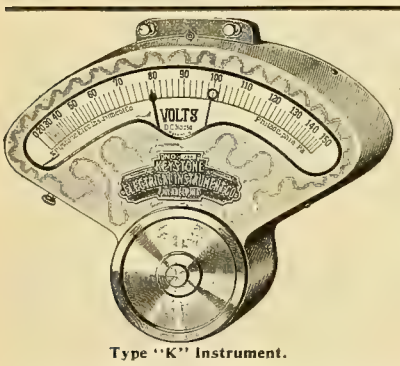
Still lead all others

in efficiency, maintenance of candle power and careful attention to details of construction.

New York, 120 Broadway; Philadelphia, Girard Building; Boston, Exchange Building; St. Louis, American Central Building; Chicago, New York Life Building; Tacoma, Wash., 907 Pacific Ave.; Syracuse, N. Y., Bastable Building; Buffalo, N. Y., Guaranty Building; San Franscisco, Mills Building; Pittsburg, Westinghouse Building; Atlanta, Ga., Equitable Building.

For sale by leading supply houses.

Sawyer-Man Electric Company.
Allegheny, Pa.



Type "K" Instrument.

Keystone Electrical Instrument Co.

Switchboard Voltmeters, Ammeters, Ground Detectors and Differential Voltmeters.

We meet all the requirements of modern Central Stations or Isolated Plants, whether using direct or alternating current circuits.

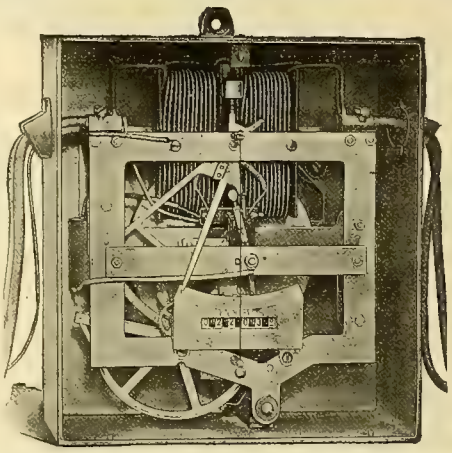
Our instruments are constant and durable, sensitive and accurate, pleasing in appearance and always correct.

We can interest you in prices and other details if you will write to

Ninth Street and Montgomery Avenue, Philadelphia.
New York, 15 Cortlandt Street.
Chicago, 231 South Canal Street.

THE AMERICAN ELECTRIC METER CO.

9th St. and Montgomery Ave., Philadelphia, Pa.,



Is now prepared to take orders for immediate delivery of all sizes of 3-Wire Constant Potential Registering Meters.

This meter is calibrated ready for instant use.
This meter requires no knowledge of electricity to erect.
This meter shows the load passing every instant.
This meter is hermetically sealed.
This meter measures correctly with uneven loads.
This meter is magnetically shielded and has no permanent magnetism.
This meter can be calibrated with a watch in six minutes.
This meter requires no lubrication.
This meter is direct reading, having no multiplier or dials.
This meter will operate for years without opening.
This meter has no springs, jewels, frictional errors or lag.
This meter once right is always right.

ANNUNCIATORS AND BELLS!

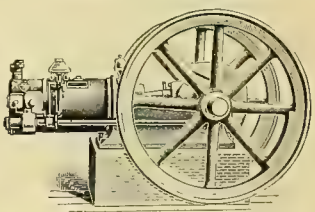
CATALOGUES AND PRICES ON APPLICATION.

PARTRICK, CARTER & WILKINS, 125 South Second St., PHILADELPHIA.

What Are You Paying for Lights or Power?

If more than one cent per h. p. hour, or getting less than 10 16-c. p. lights for one cent, you had better put in an

OTTO GAS ENGINE



Hundreds of plants in successful operation to refer to.

The Otto Gas Engine Works, Phila.

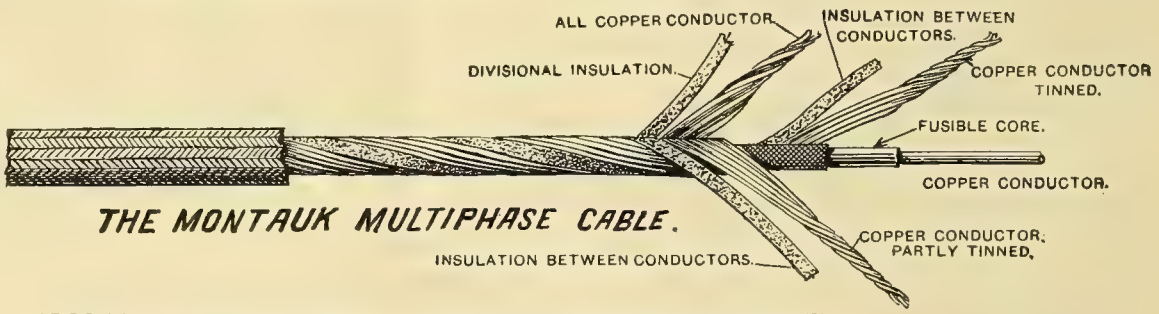
New York. Boston. Chicago. Omaha.

Interior Thermostatic Electric Cables.

STANDARDIZED IN ALL B. & S. GAUGES.

We own the following Letters Patent issued by the United States, which broadly cover the construction and basic principle of our cables, viz.:

No. 546,261
No. 546,262
No. 565,053
No. 565,178
No. 565,188
No. 565,217
No. 565,410
No. 594,034
No. 594,247
No. 594,281



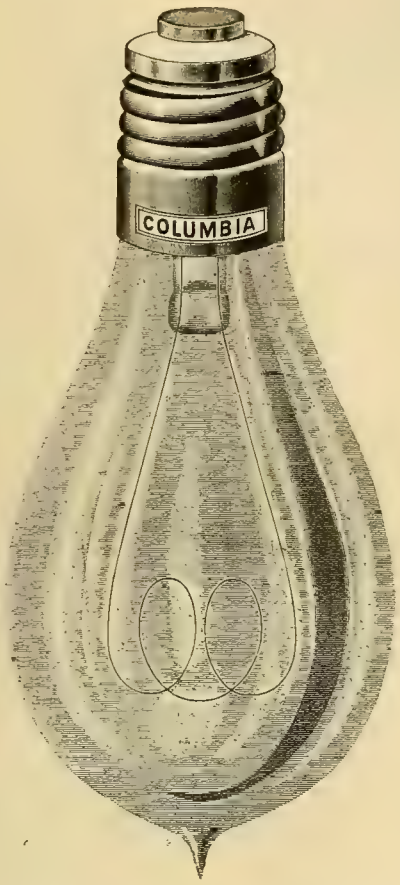
THE MONTAUK MULTIPHASE CABLE.

ADOPTED BY THE GAMEWELL AUXILIARY FIRE ALARM COMPANY.

Write for Descriptive Matter.
Call and See Cables Demonstrated.

MONTAUK MULTIPHASE CABLE CO.,

100 BROADWAY. TELEPHONE, 403 CORTLANDT. NEW YORK.



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COLUMBIA RAILWAY LAMPS

for series burning on electric street railway circuits, to be absolutely uniform in the consumption of current, thereby insuring a uniform distribution of light throughout the cars.

Special round bulb lamp for headlight purposes suitable to burn in series with the other lamps.

Trial orders solicited.

Lamps in stock at branch offices.

The Columbia Incandescent Lamp Co.,

MAIN OFFICE AND FACTORY:

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Branch Offices: NEW YORK, 1311 Havemeyer Building. CHICAGO, 1236 Monadnock Building. SAN FRANCISCO, Paul Seiler Electric Works.

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FALL STOCK OF

PORCELAIN!

NOVELTIES - SPECIAL GOODS

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PERU ELECTRIC MNFG. CO.,

PERU, IND.

POST YOURSELF

on present market prices of staple goods by sending for our latest net revised price list of

Sockets,
Receptacles,
Cut-Outs,
Tubes,
Cleats,
Insulators.

Electric Appliance Company,

Electrical Supplies. 242 Madison St., Chicago.

Send for Samples and Prices of

SAMSON SPOT CORD

For Arc Light and Trolley Cord.

WATERPROOFED.

SAMSON CORDAGE WORKS, BOSTON, MASS.

Automatic Time Switches

FOR CONTROLLING

ELECTRIC LIGHTS and POWER CIRCUITS.

Entirely Automatic and Absolutely Reliable. Also

ARC CUT-OUTS for High Tension Arc Circuits. The BEST APPLIANCES of the Kind are Manufactured by

THE CLEVELAND ELECTRIC CO.,

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RAINBOW PACKING.

Thousands of Imitators. No Equal. Will Hold Highest Pressure.

THE COLOR OF RAINBOW PACKING IS RED.

Don't have to use wire and cloth to hold RAINBOW. Can't blow it out.

Three rows of Diamonds in Black throughout the length of each and every roll. No baking or following up.

Patented and Manufactured Exclusively by

PEERLESS RUBBER MFG. CO., 16 WARREN ST., NEW YORK.

16-24 Woodward Avenue, DETROIT, MICH.

202-210 S. Water Street, CHICAGO, ILL.

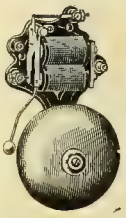
Outlet or Junction Boxes.

WARD LEONARD ELECTRIC CO.
BRONXVILLE, N. Y.

H. P. BROUGHTON, E. E.

Contractor for Municipal and Isolated Electric Light Plants, Security Bldg., St. Louis.

IRON ARMORED CONDUIT WORK A SPECIALTY.



Best Bell Style F.

KNOWN BY ITS GOOD POINTS.

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MARTIN J. INSULL,

Manufacturers' Agent,

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C. & C. **DYNAMOS AND MOTORS,** Sole agent.

Fort Wayne **INCANDESCENT LAMPS.**

D. & W. **ENCLOSED FUSES** and other specialties Sole agent.

Gravity Motor Controllers, Sole agent.

Bergmann **SWITCHES** and supplies, Sole agent except for Cook county.

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Consulting Engineer,
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Solicitor of Patents
Expert in patent causes.
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ELECTRICAL AND MECHANICAL ENGINEER.

Estimates, plans, specifications, superintendence and tests for lighting and power plants. Motor work and electrical equipment for shops and factories a specialty.

WOVEN WIRE BRUSHES.

Made from Pure Copper, Alloy, Brass or Bronze.

Any degree of flexibility. GRAPHITE LUBRICATION if required. Any style at lowest prices. Send for descriptive circulars and prices. Manufactured by

OHIO ELECTRIC SPECIALTY MFG. CO., TROY, O., U.S.A.

Send your rush orders for **FAN MOTORS** to the **ST. LOUIS ELEC. SUPPLY CO., 911 MARKET STREET, ST. LOUIS, MO.**

We have 'em—**EMERSON ALTERNATING** and **WESTERN ELECTRIC DIRECT CURRENT.**

SPARKING reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use

50 Cents per Stick.
$5.00 per Dozen.

SEND FOR FREE SAMPLE STICK.

For sale by all Supply Houses, or

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum the Brushes.

It will put that high gloss on the Commutator you have so long sought after.

K. McLENNAN & CO., Sole Manufacturers, 909, 100 Washington St., CHICAGO.

Fort Wayne Electric Corporation,

FORT WAYNE, IND.

Apparatus for

Arc, Direct Current and Alternating Incandescent Lighting and Power Transmission.

INDIA & AMBER **MICA** IN ANY SHAPE OR PATTERN.

FOR ARMATURE COILS AND FIELDS.

EMPIRE INSULATED Cloths and Papers.

M·I·C· COMPOUND UNEQUALED.

PERFECT **MICANITE** INSULATOR REGISTERED.

Eugene Munsell & Co. 218 Water St. New York & Mica Insulator Co. Chicago, 117 Lake St.

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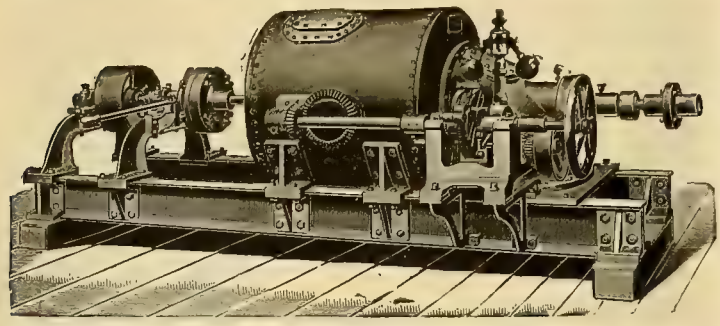
Victor Turbine Water Wheel.



Cylinder or Register Gate - Close Regulation and High Efficiency at Full and Partial Gate.

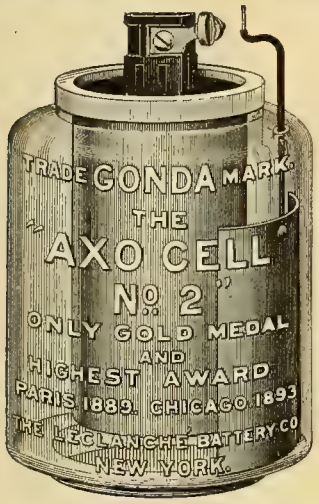
The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

SEND FOR CATALOGUE AND PARTICULARS.

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs on [illegible] scale and where the situation admits of their use we recommend them.

THE STILWELL-BIERCE & SMITH-VAILE CO., DAYTON, OHIO.



The Standard Open Circuit Batteries of the World.

SEND FOR CIRCULAR AND PRICES.

THE LECLANCHÉ BATTERY CO.,
111 to 117 East 131st St., N. Y.

PERHAPS YOU HAVE HEARD

Of a railway system running between Chicago, Milwaukee, St. Paul, Minneapolis, Ashland and Duluth, known as the Wisconsin Central Lines. Before making a journey to any of these northwestern points, inquire relative to the fast and elegantly equipped trains which leave Chicago daily via the Wisconsin Central. Your nearest ticket agent can give you complete information.

JAS. C. POND, G. P. A., Milwaukee, Wis.

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See a copy of our latest catalogue of Electrical Books? 100 pages, mailed free.

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CEDAR POLES

LINDSLEY BROS.,
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WHOLESALE PRODUCERS.

Cedar Poles

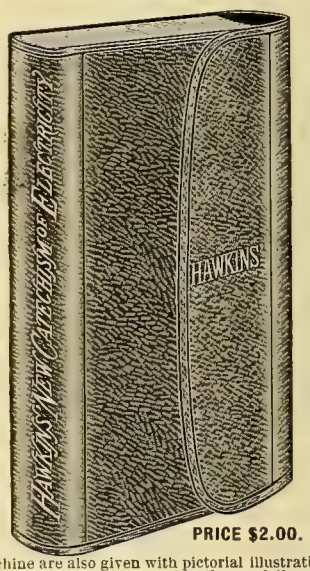
TORREY CEDAR CO.,
CLINTONVILLE, WIS.
Large Stock Constantly on Hand.

POLES AND CROSSARMS

BERTHOLD & JENNINGS,
CHEMICAL BUILDING, ST. LOUIS.

HAWKINS' NEW CATECHISM OF ELECTRICITY.

Plan of the Work, Contents, Etc.



PRICE $2.00.

The New Catechism of Electricity will be found to be surprisingly plain, and free from useless and ambiguous terms. The plan upon which it is arranged is unique.

The book is, first of all, intended to be plain and instructive; some 300 illustrations have been introduced, so that the mere pictures will afford almost a knowledge of the subjects.

It is a school book from the manner in which it proceeds from the simple facts to the abstract principles which the facts indicate; it is also a book of reference through the index of seventeen double columns of fine type pages; by means of this index a thousand items of practical importance are at once available.

It is an up-to-date work, which has cost a large outlay of capital and time, and, in short, it is doubtful if any more attractive book has ever been issued—or one more useful.

The subjects treated upon are as follows: Dedication to Thomas A. Edison, with engraving of Mr. Edison; Preface and Introduction; Nature and Source of Electricity and Magnetism.

The Dynamo; Conductors and Non-Conductors; Symbols, abbreviations and definitions relating to electricity; Parts of the Dynamo; The Motor; The Care and Management of the Dynamo and Motor.

Electric Lighting; Wiring; The rules and requirements of the National Board of Underwriters in full; Electrical Measurements.

The Electric Railway; Line Work; Instruction and Cautions for Linemen and the Dynamo Room; Storage Batteries; Care and Management of the Street Car Motor; Electro Plating.

The Telephone and Telegraph; The Electric Elevator; Accidents and Emergencies, etc., etc.

The full one-third part of the whole work has been devoted to the explanation and illustrations of the dynamo, and particular directions relating to its care and management;—all the directions are given in the simplest and most kindly way to assist rather than confuse the learner. The names of the various parts of the machine are also given with pictorial illustrations of the same.

In the Catechism no less than 25 full page illustrations have been given of the various dynamo machines made in different parts of the country, and an equal number of part page illustrations.

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THE OMAHA EXPOSITION.

When the World's Fair at Chicago ceased to exist, it was supposed that we should never look upon its like again. However, the Trans-Mississippi Exposition at Omaha has effectively reproduced in similarity all of the buildings which made the White City so attractive in 1893.

It does not now take two weeks to wander through grounds and structures and then be compelled to go away with a jumble of ideas, for the Omaha Exposition people have profited by past experience, and have so improved the arrangement of exhibits that no more than two or three days of time need be consumed in admiration and inspection of the marvelous resources of the West, collected together in the chief city of Nebraska.

Even the new Midway is a reproduction of the far-famed Street of All Nations of 1893, with many improvements upon the original.

The electric lighting of the buildings, grounds and lagoons at night makes a scene of enchanting beauty, alone worth traveling a thousand miles to see.

The means of communication between the city and grounds are ample, and the distance to be traversed is short.

The ways of reaching Omaha are innumerable, but chief among them is the direct Chicago and Omaha short line of the Chicago, Milwaukee & St. Paul Railway, with its electric lighted, vestibuled trains, leaving Chicago every night at 6:15 p. m., and arriving Omaha at 8:20 the next morning. Dining car service en route.

Excursion tickets are on sale at every coupon ticket office in the United States over the Chicago, Milwaukee & St. Paul Railway through Northern Illinois and Central Iowa, as well as at 95 Adams street, and at the Union Passenger Station, Canal and Adams streets, Chicago.

HELLO!

Who Leads in Telephone Wood Specialties?

The Cabinet Manufacturing Company,

STEUBENVILLE, OHIO.

THEY STILL USE IT.

Stover Bicycle Manufacturing Co.

IT COSTS SO LITTLE AND WORKS SO WELL

FREEPORT, ILL., March 2nd, 1897.

The Boiler Expurgator Co., Chicago, Ill.

Gentlemen:—I have just used your Boiler Expurgator with astonishing results. To begin with I have always been very sceptical in regard to the different boiler compounds and would never have tried yours had not a friend of mine who runs between Dubuque and Chicago on the Illinois Central induced me to use it, telling me of the results he had obtained on his locomotive. It goes beyond anything I ever tried and we have tried numerous compounds, and I can conscientiously say that I never expected to secure anything that would do the work of your Boiler Expurgator. We cheerfully recommend it to anyone and you may refer to us at any time.

Very truly yours,
STOVER BICYCLE MFG. CO.
W. A. Hance, Supt.

Cost per week: 10 to 40 h. p., 25c.; 40 to 80 h. p., 37½c.; 80 to 120 h. p., 50c.; 120 to 160 h. p., 62½c.; 160 to 200 h. p., 75c.

The Boiler Expurgator Co., MANUFACTURERS, CHICAGO, U. S. A.

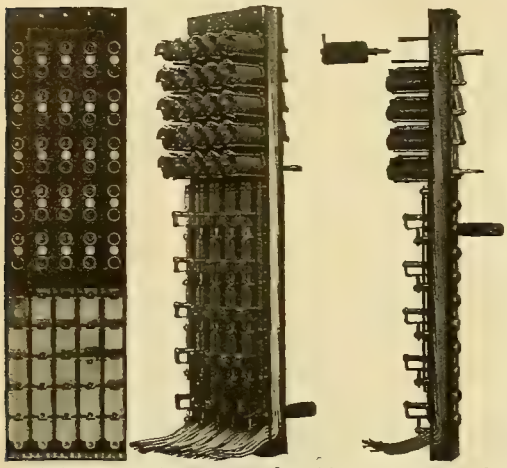
A few agencies will be placed in large steam and manufacturing centers. Write us at once.

The Most Reliable General Telephone Apparatus Manufacturers in the World.

THE VICTOR TELEPHONE MFG. CO.,

166 to 174 S. CLINTON ST., CHICAGO.

Fully Protected by Patents.



All other makes of boards have from *three to six wires* leading from jacks at back of board. **The Victor has none.**

A Victor one hundred cabinet may be partially fitted with jacks and drops to any portion of its capacity economically and increased gradually with **Victor** five jack and drop sections, according to requirements.

The Victor Metallic Express Switchboard is now upon the market. This board is the **most satisfactory** ever offered to the telephone public. It is **durable** and **simple,** containing no **useless trappings or superficial parts.** It is durable and simple in construction, **easy and rapid to operate** and **inexpensive to maintain. All parts** are **interchangeable and accessible without interfering with other parts or interruption of operation.** This board is built in sections of five drops and jacks, mounted on hard rubber, **invisibly wired** and so constructed that when assembled it has the appearance and in fact is **one solid front.** Each subscriber has an **individual ringing key** and the **gravity drop** used is a special feature, owing to its **positive action and easy restoration.**

Our **VICTOR** exchange and long-distance telephones are equipped with our **powerful** and **never failing generators** and **ringers, positive contact switch, our high efficiency solid back transmitters and VICTOR bi-polar receivers.**

OUR SPECIALTIES ARE:

The Victor

Non-Disconnecting Lightning Arresters.
Combination Cross Connecting Fuse Board.
Fusible Cut-Out Blocks.
Special Extension Bells.
Special Bridging Bells.
Special Generators.

Write us for details and particulars and we will surely interest you.

Victor Telephone Manufacturing Co.,

166 to 174 S. CLINTON ST., CHICAGO.

THE ORATOR.

The ORATOR AND Improved Hunnings

solid back dust transmitters in Wall, Desk and Cabinet Styles. They are **Convenient, Durable** and the **best** of **talkers.**

A trial will convince anyone of their superiority on either short or long distance work.

Anyone can make an instrument that will work well at first, but to produce one that will **continue** to meet every proper demand is quite another problem.

The **ORATOR** will.

MANUFACTURED BY

The RAWSON ELECTRIC CO.,
ELYRIA, O., U. S. A.

Telephone Men!

Read Webb's "Telephone Hand-Book." Price, $1.00. . . .

Electrician Publishing Company,
Suite 510 Marquette Bldg., Chicago.

DON'T THINK

That you can keep posted as to what is going on in the western electrical field without reading the **Western Electrician.** It is **the electrical newspaper,** and if you are not a subscriber you will find it to your advantage to become one at once.

$3.00 per year;
$1.50 for six months.

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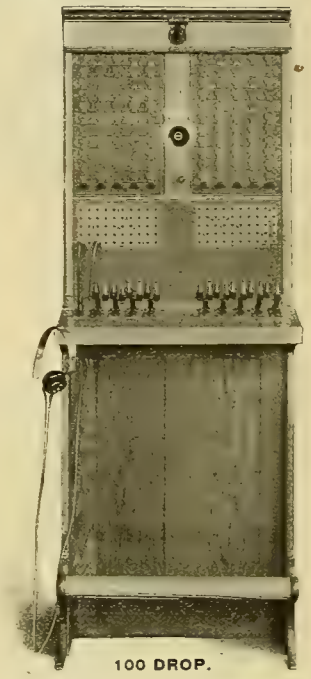
Switchboards

Similar to the Bell for Independent Telephone Companies.



100 DROP.

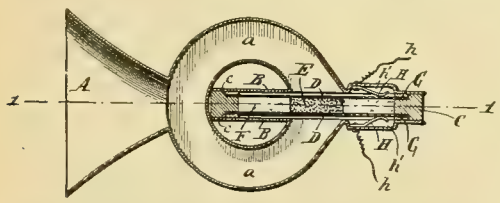
Distributing Boards, Cable Terminals and Protective Devices the same as those used by the Bell company.

Sterling Electric Co.,

71-73 W. ADAMS ST., CHICAGO.

THE DOUBLE DIAPHRAGM

of the **Wilhelm Transmitter** secures a double compression of the carbon granules in the pocket between them, greatly increasing the volume, distinctness and carrying value of the voice. Will not "pack" under any circumstance, and cannot be injured by rough handling or pencil jabbing.



Recognized by experts as containing features that place it far ahead of all others.

WILHELM TELEPHONE MFG. CO.,

Caxton Building, Buffalo, N. Y.

Central Energy Telephone System

A Marvelous Success.

All parts subject to wear at central office....
...Nothing at subscriber's station to get out of repair.

TRANSMITTER **Sensitive for Office, Muffled for Factory,**

Sealed to prevent opening by inexperienced persons.

RECEIVERS **Unequalled in Power, Practically Indestructible,**

The only make perfectly reliable for central energy system.

OUR REGULAR EXCHANGE EQUIPMENT is **Complete, Durable, Reliable.**

The only manufacturers selling a complete line of Public Exchange, Toll Line, Police, Fire Alarm, Street Railway, Central Station and Intercommunicating Private Plant Telephone Apparatus fully protected by patent. We respect all patent claims of others.

The Stromberg-Carlson Telephone Mfg. Co.,

GET CATALOG. **72-82 W. Jackson Blvd., Chicago, U. S. A.**

THIS TRADE MARK
STANDS FOR THE

Best Transmitter

FOR ALL PURPOSES

EVER PRODUCED.

Among other of the BEST THINGS manufactured or controlled by us—and the fact of our name connected therewith is a guarantee of their excellence—are the

New Standard Dry Batteries.
Mason Telephone Pay Stations.
Toll-Line Arrester and Cut-Out Switch.

STANDARD TELEPHONE & ELECTRIC CO.,

MADISON, WIS.

NO. 30 AMERICAN TRANSMITTER.

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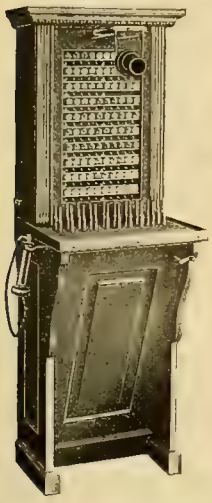

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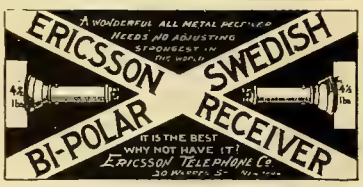

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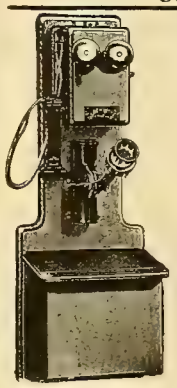

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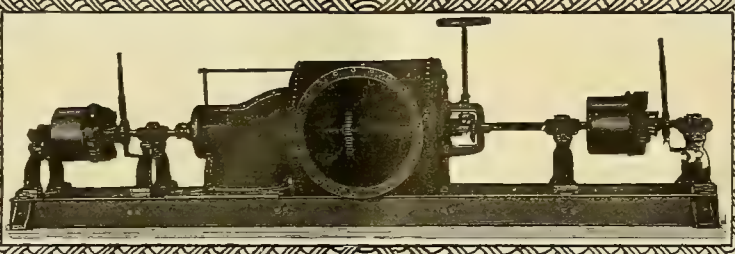

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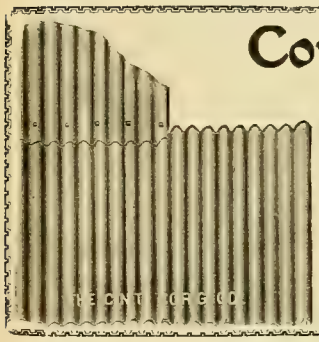

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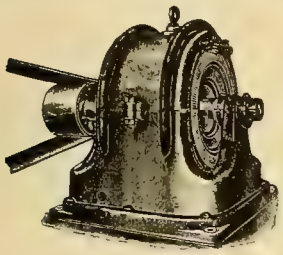

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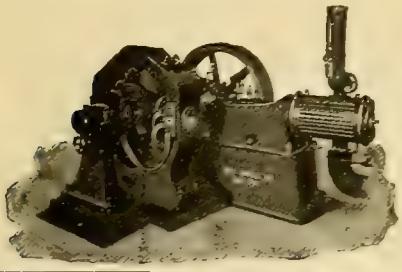

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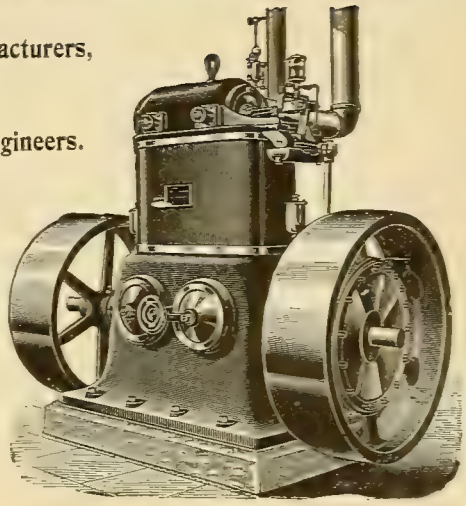

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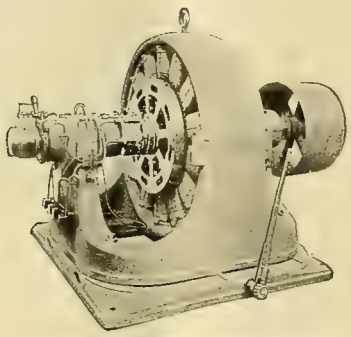

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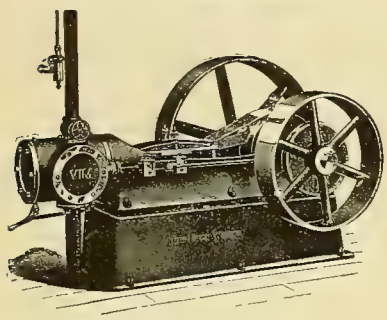

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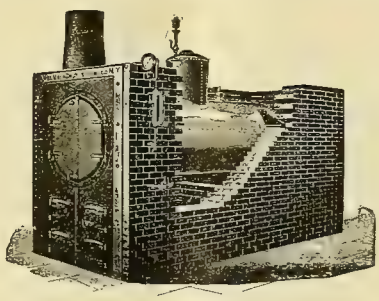

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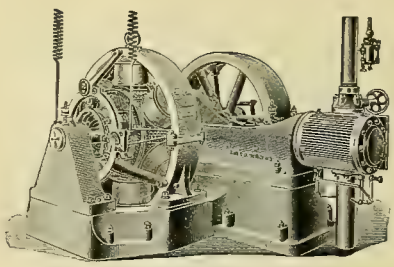

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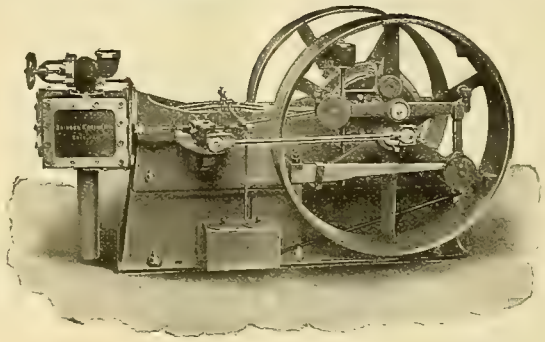

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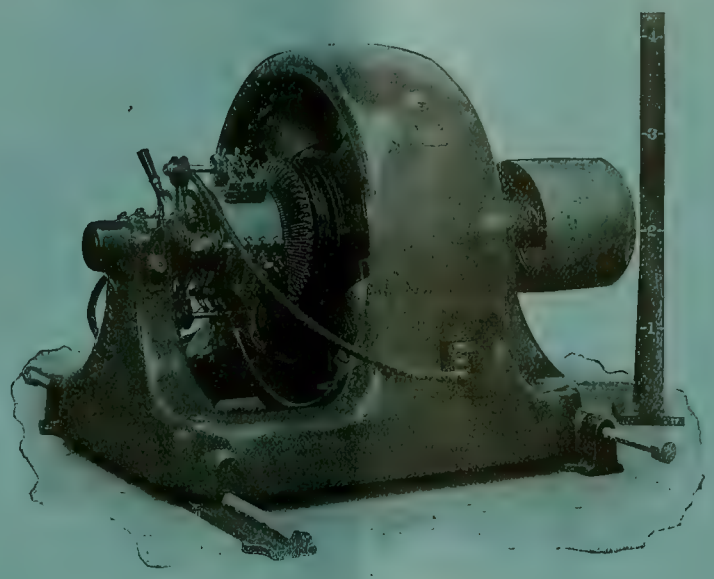

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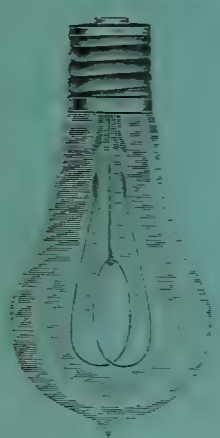

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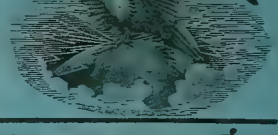

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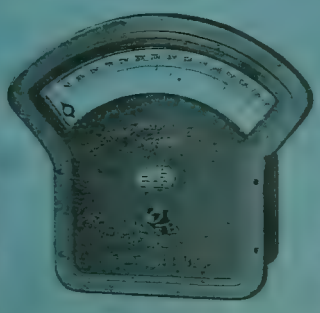

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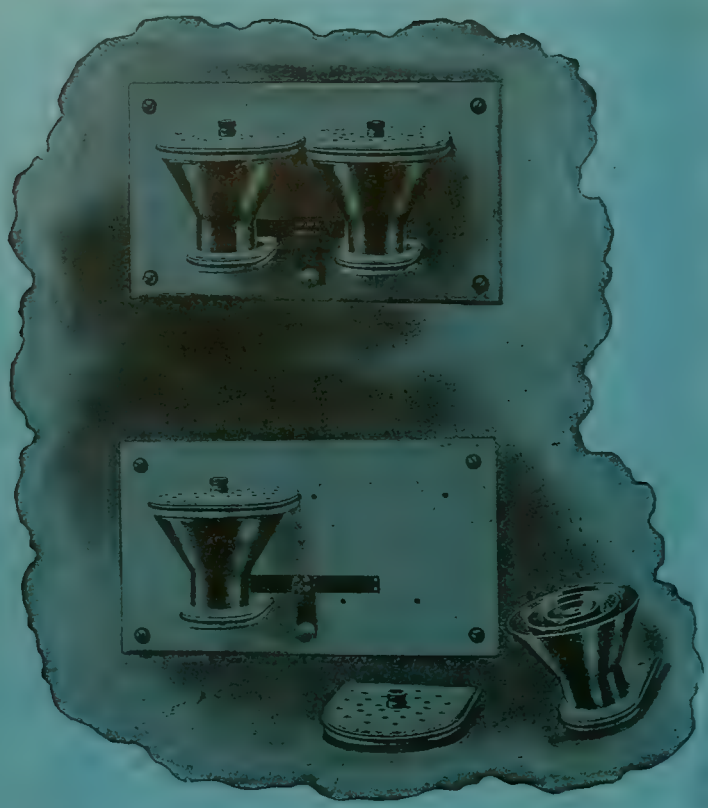

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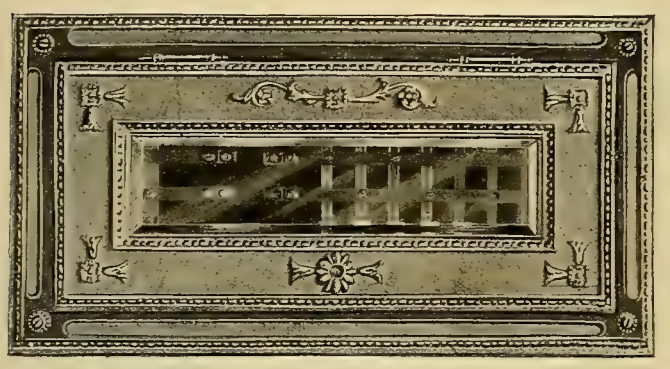

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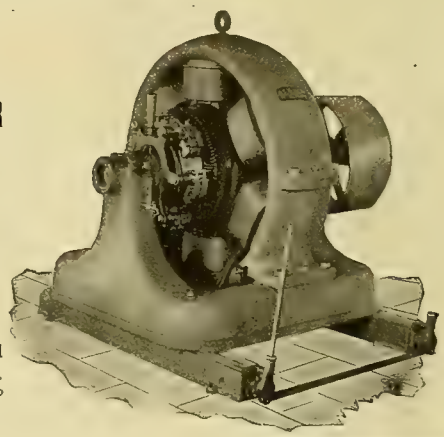

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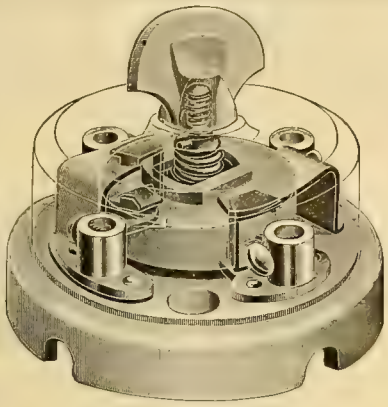

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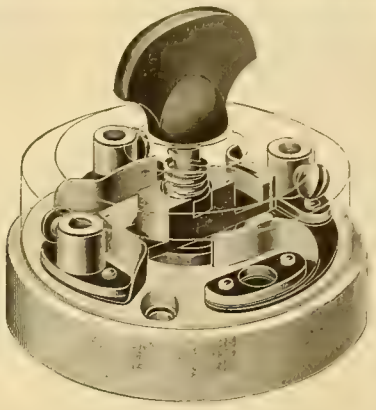

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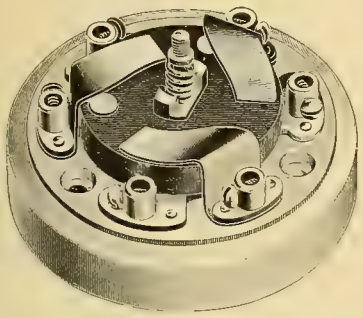

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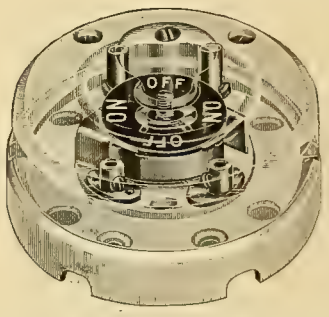

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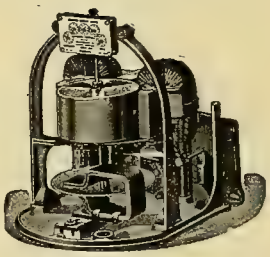

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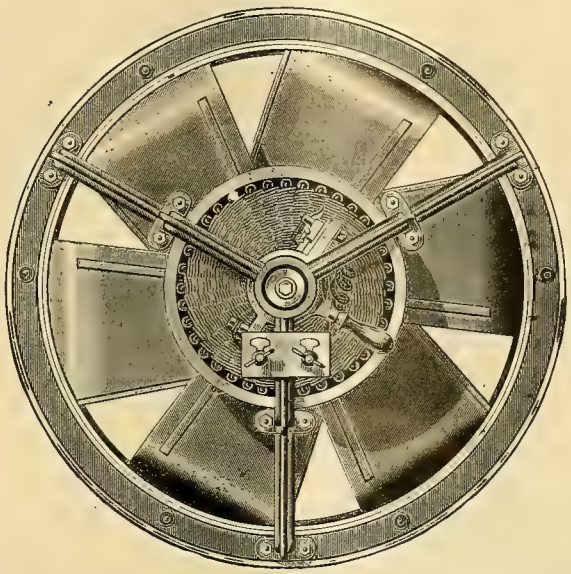

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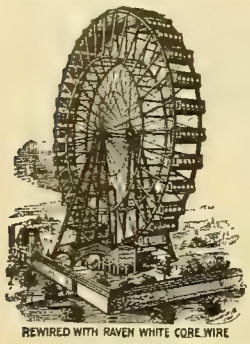
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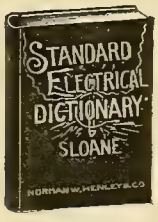

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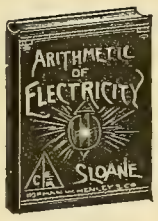

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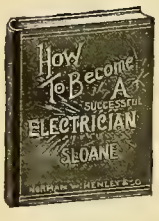

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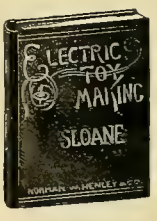

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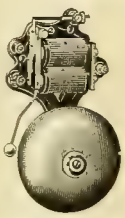

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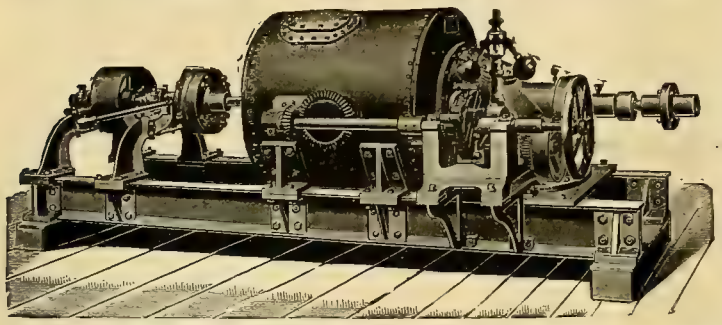

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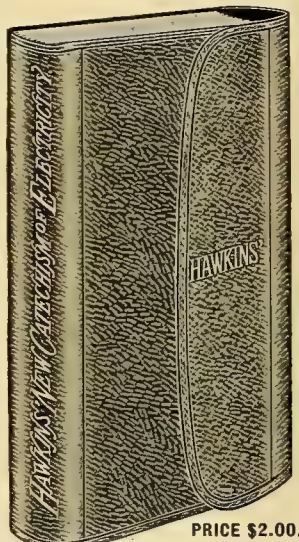

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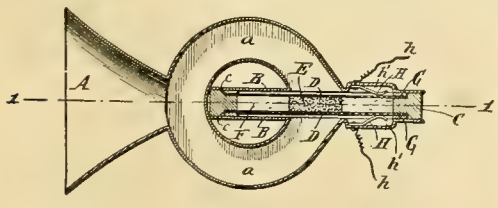

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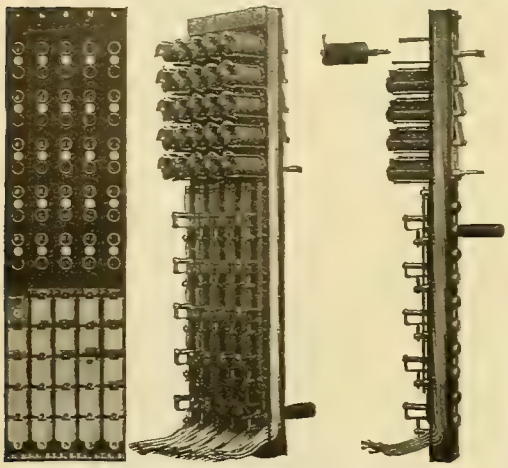

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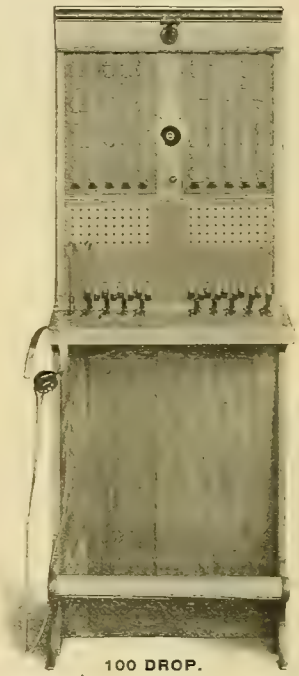

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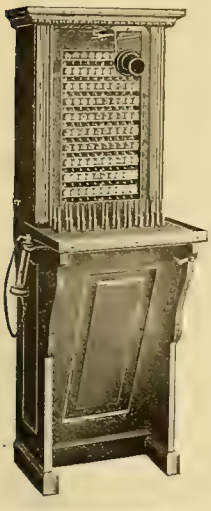

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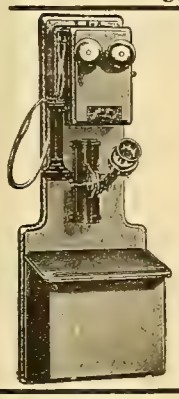

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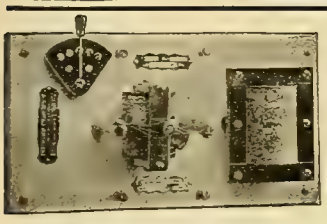

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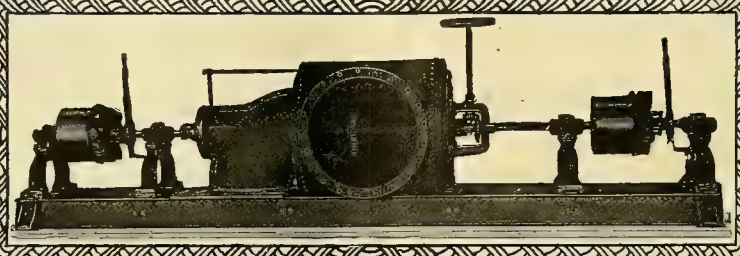

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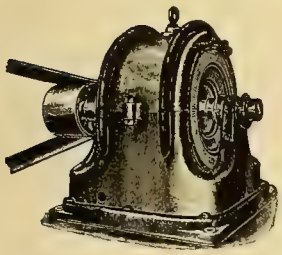

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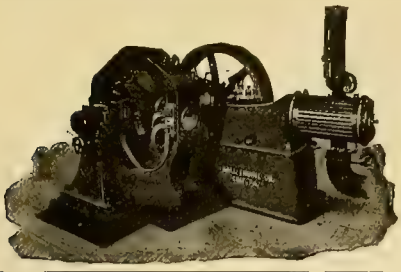

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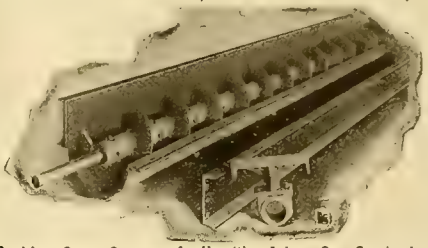

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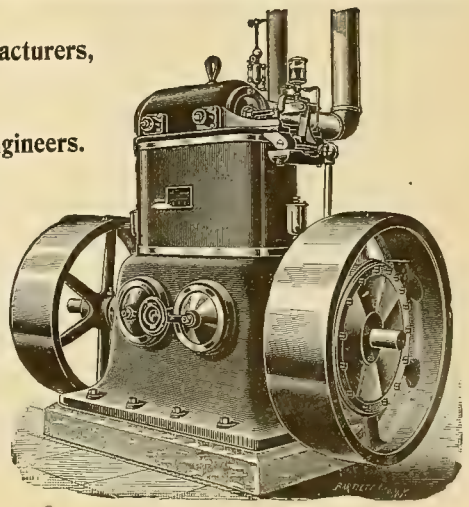

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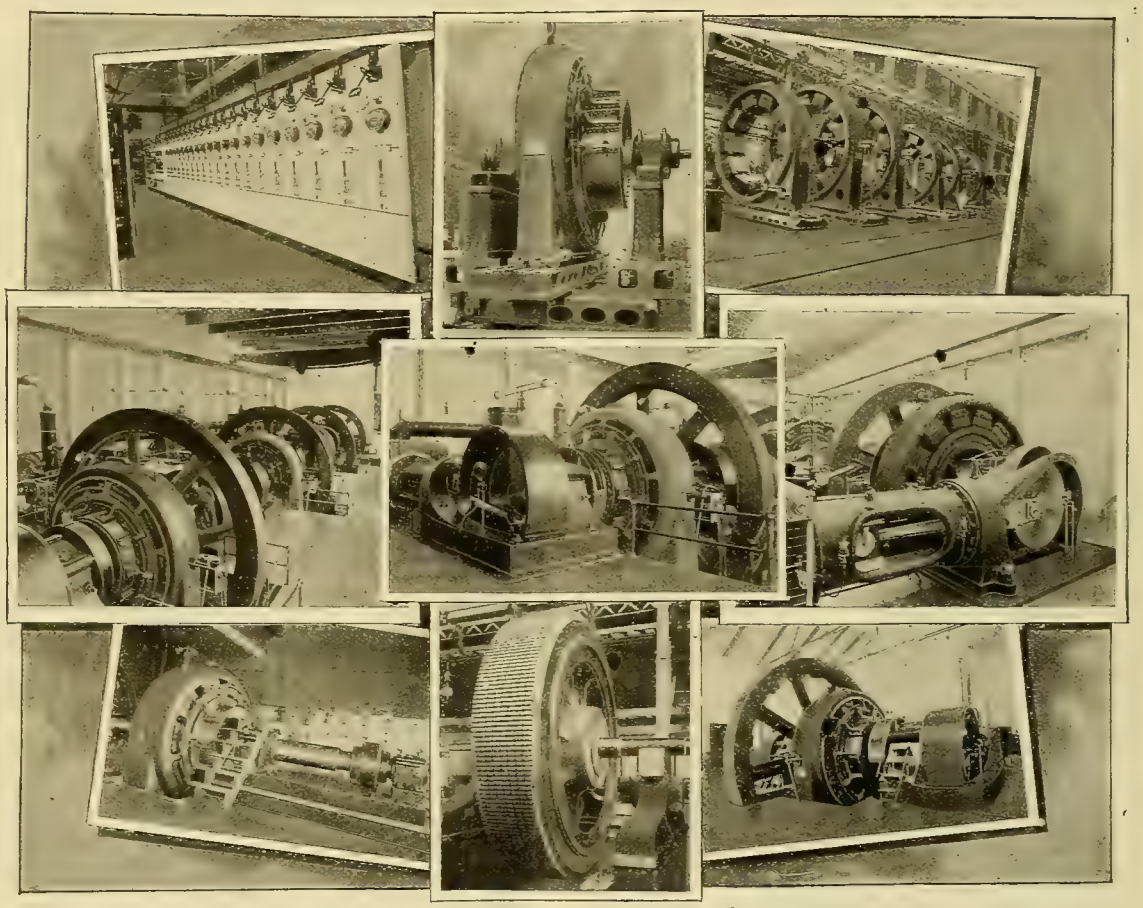

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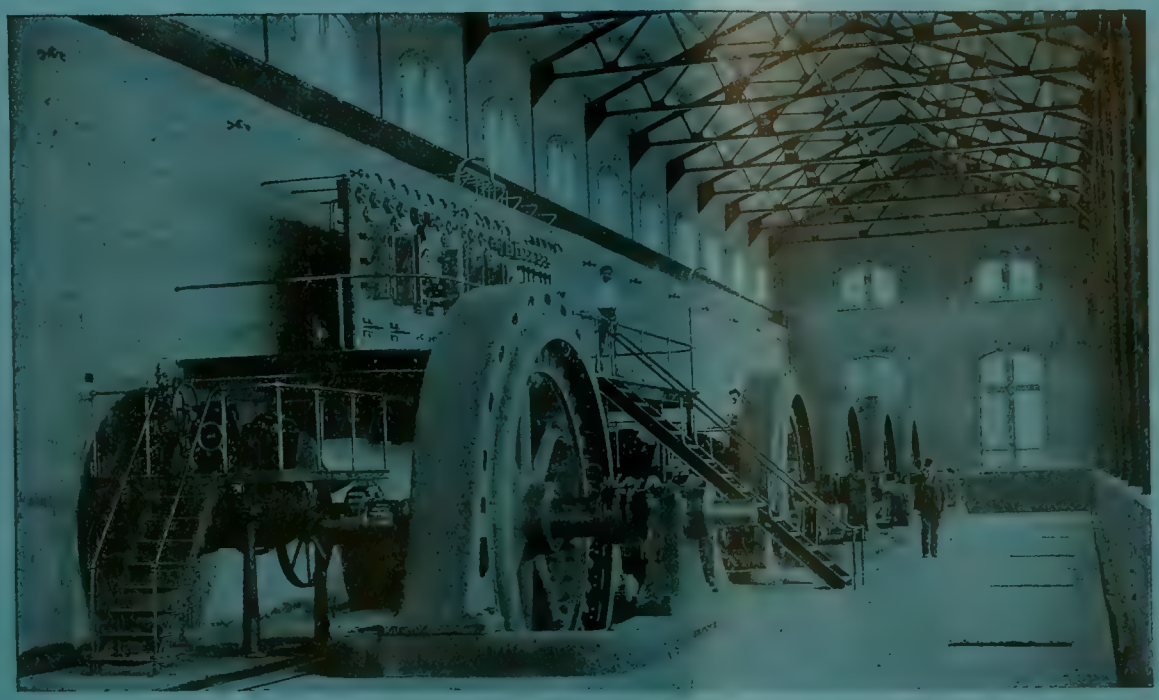

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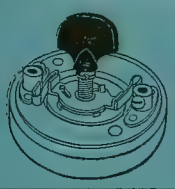

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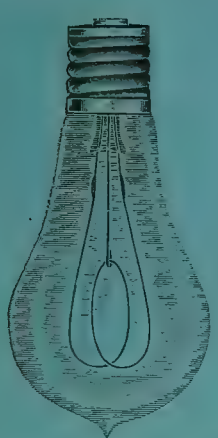

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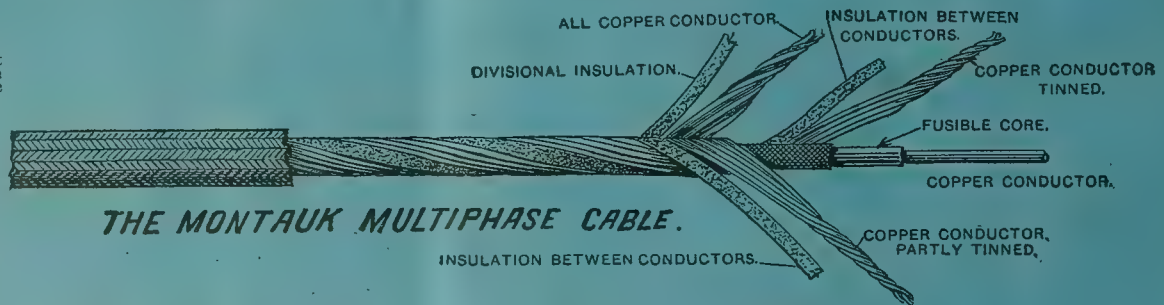

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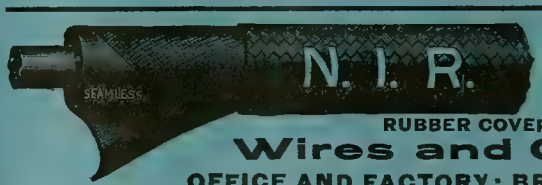

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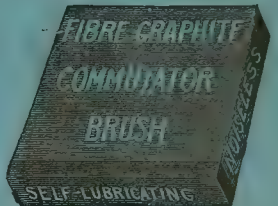

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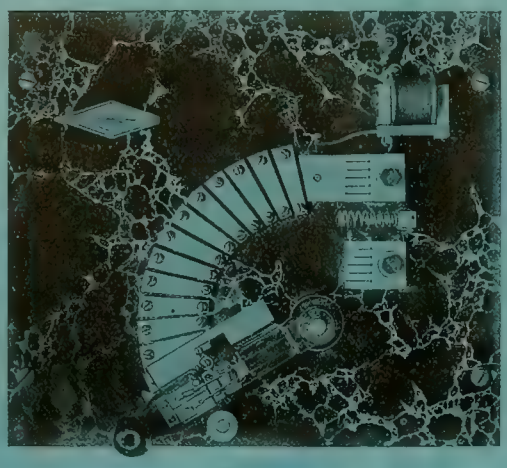

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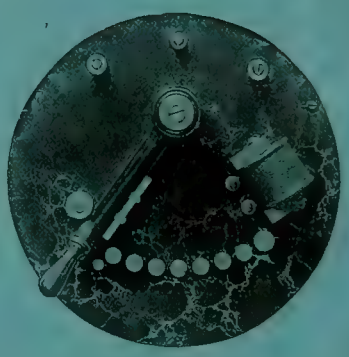

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P and B FOR PERFECT INSULATION.

The Standard Paint Co.,
NEW YORK. CHICAGO. HAMBURG. LONDON.

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

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ENCLOSED ARC LAMPS ARE THE

STANDARD.

SIMPLE, SAFE, MECHANICAL, EFFICIENT.

150—HOURS—150

ALTERNATING

AND

DIRECT CIRCUITS.

110, 220, 550 VOLTS
3 TO 5 AMPERES.

THOUSANDS OF PIONEERS IN USE IN NEW YORK CITY.

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Removing a Burnt-out Street Lamp.

Incandescent Electric Light Manipulator.

This device will remove Burnt-out Bulbs from high ceilings and chandeliers and clean the same without the aid of ladders of any description.

I want active agents in every town, city and state in the United States.

Send and get descriptive circular.

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STANDARDIZED IN ALL B. & S. GAUGES.

We own the following Letters Patent issued by the United States, which broadly cover the construction and basic principle of our cables, viz.:

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No. 546,262
No. 565,053
No. 565,178
No. 565,188
No. 565,217
No. 565,410
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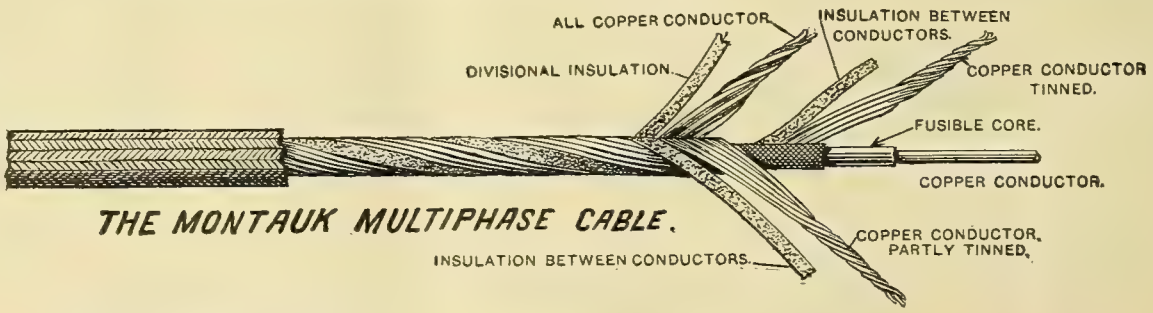
No. 594,247
No. 594,281



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ADOPTED BY THE GAMEWELL AUXILIARY FIRE ALARM COMPANY.

Write for Descriptive Matter.
Call and See Cables Demonstrated.

MONTAUK MULTIPHASE CABLE CO.,

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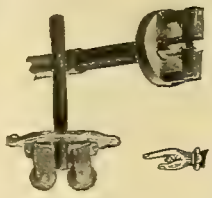

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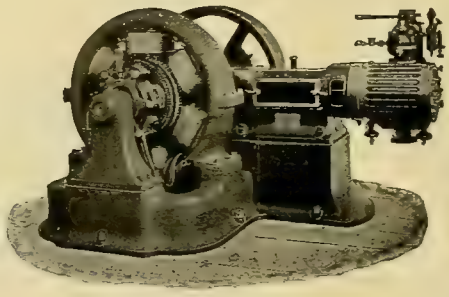
Motors,
Direct-Connected,
Slow Speed,
Moderate Speed,
Mining Locomotives.



All of the highest efficiency, most modern construction and most graceful design.

WRITE FOR CIRCULARS AND READ OUR GUARANTEE.

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Sargent & Lundy.
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Walker Company.
Western Electric Co.
Western Elect Supply Co.

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Electric Ry. Equipment Co.
Farr Tel. & Cons. Sup. Co.
Western Elect. Supply Co.

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Westinghouse El. & Mfg. Co.

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Central Electric Co.
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Walker Company.
Western Electric Co.
Western Elect. Supply Co.
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Kartavert Mfg. Co.
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Fixtures, El. & Comb'n.
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Commercial El. Supply Co.
Western Elect. Supply Co.

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Stow Mfg. Co.

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Central Electric Co.
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Central Electric Co.
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Illinois Electric Co.
Kartavert Mfg. Co.
Mass. Chemical Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Paiste Co., H. T.
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Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
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Sawyer-Man Elec. Co.
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General Electric Co.
Link-Belt Machinery Co.
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Akron Elec. Mfg. Co.
Beck, A., Electric Co.
Bullock Elec. Mfg. Co.
Chicago Rheostat Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hobart Elec. Mfg. Co.
Illinois Electric Co.
Insull, Martin J.
Sargent & Lundy.
Stanley Elec. Mfg. Co.
United Elec. Imp. Co.
Wagner Elec. Mfg. Co.
Walker Company.
Warren Elec. Mfg. Co.
Western Electric Co.
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Westinghouse El. & Mfg. Co.

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Besly & Co. Chas. H.
Garlock Packing Co.
Link-Belt Machinery Co.
Peerless Rubber Mfg. Co.

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American Pegamoid Co.
Atlantic Alcatraz Asph. Co.
Central Electric Co.
Commercial El. Supply Co.
Mass. Chemical Co.
Standard Paint Co.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co. Ltd.
Standard Brass Works.

Platinum.
Baker & Co.

Poles.
Berthold & Jennings.
Central Mfg Co.
Electric Ry. Equipment Co.
Lindsley Bros.
Torrey Cedar Co.

Porcelain.
Central Electric Co.
Commercial El. Supply Co.
Empire China Works.
Peru Elec. Mfg. Co.

Refiners.
Swarts Metal Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.

Re-Winding—Repairs.
Beck, A., Electric Co.
Chicago Armature Co.
Chicago Edison Co.
Hodge, Walsh & Loring.

Rheostats.
Chicago Rheostat Co.
Cutler-Hammer Mfg. Co.
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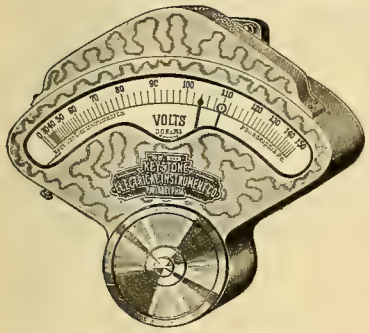

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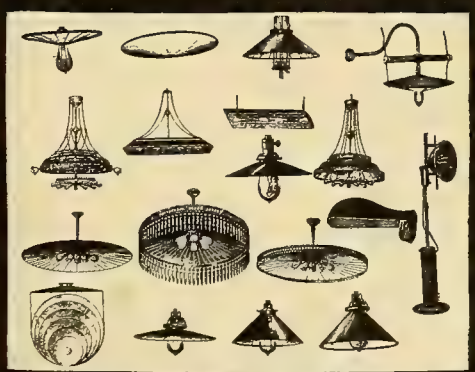

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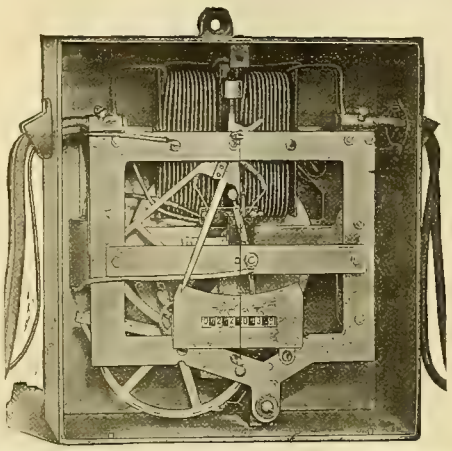

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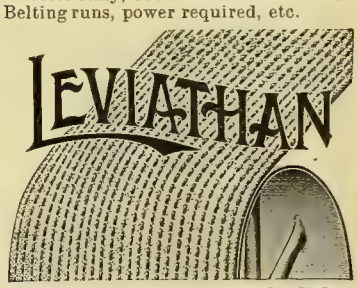

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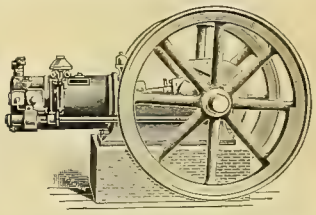

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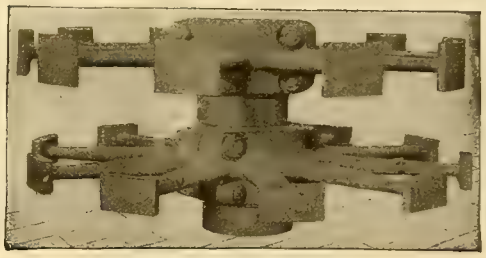

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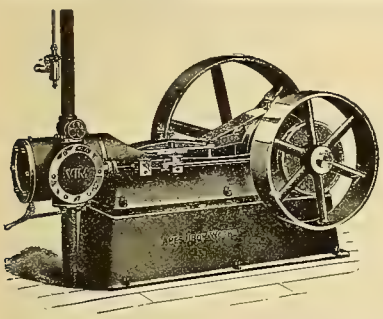

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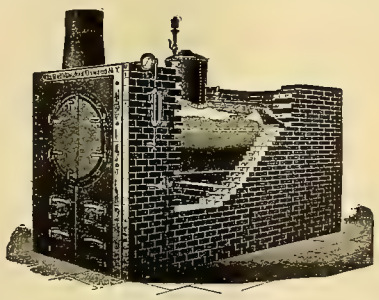

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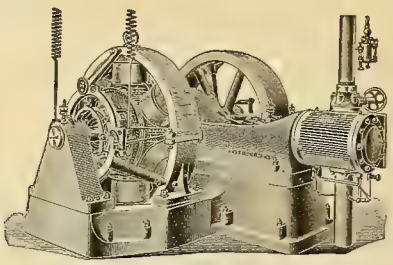

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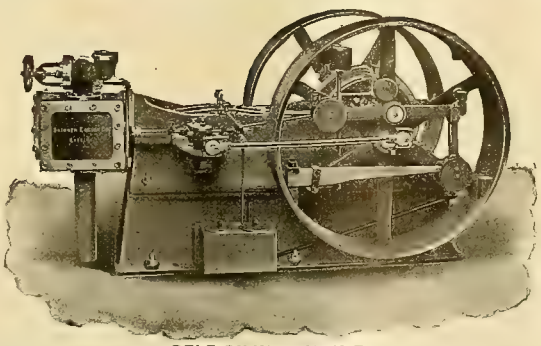

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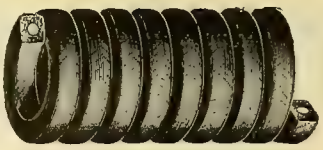

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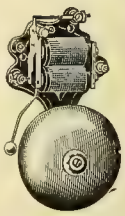

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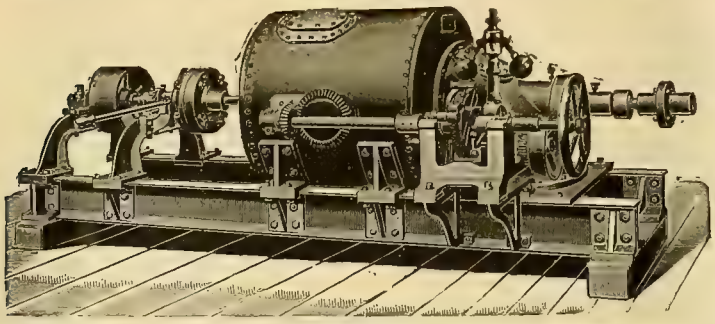

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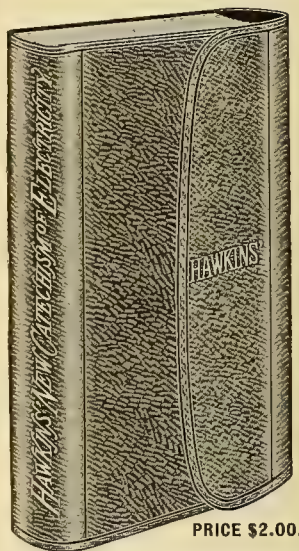

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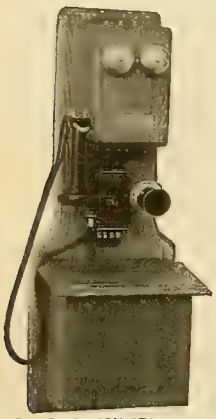

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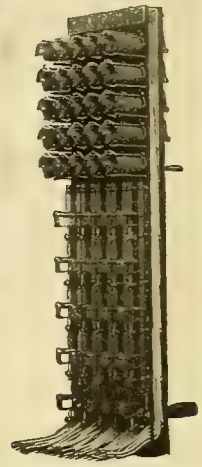

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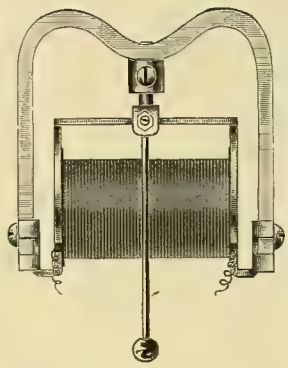

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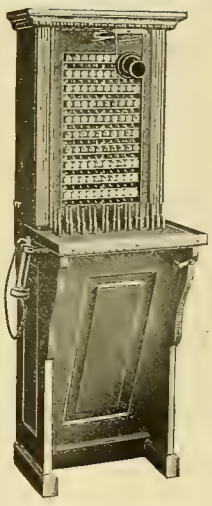

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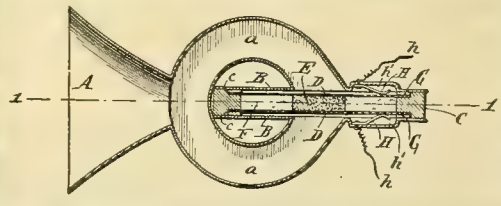

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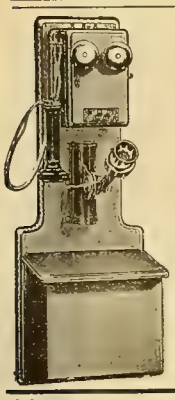

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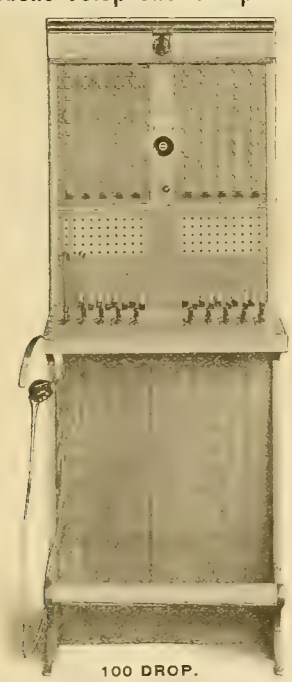

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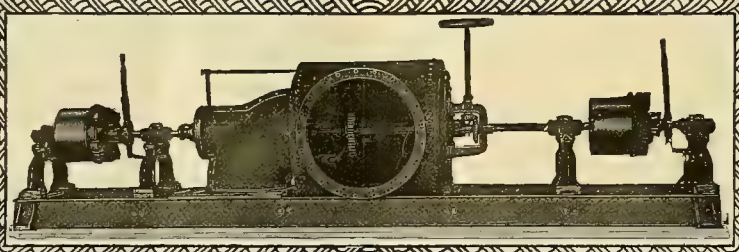

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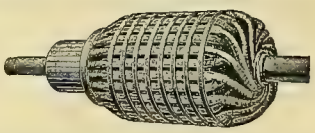

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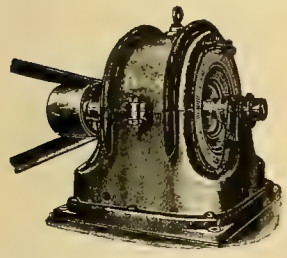

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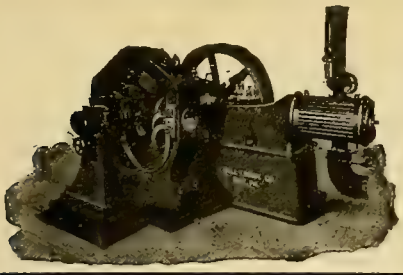

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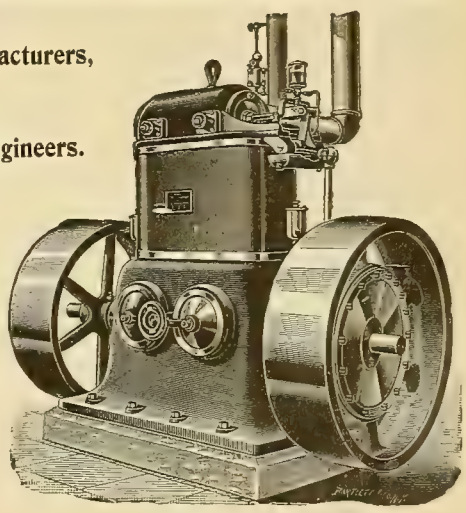

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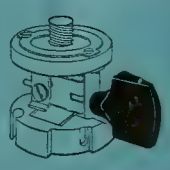

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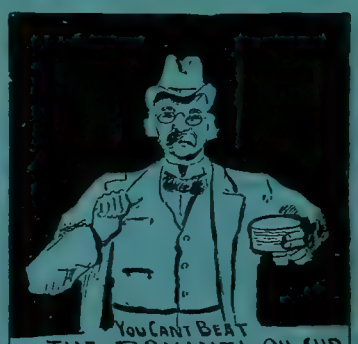

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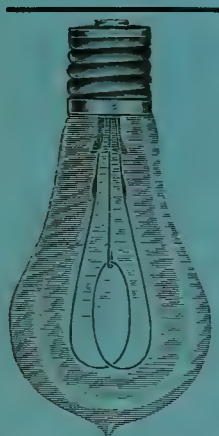

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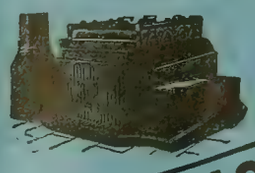
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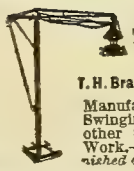

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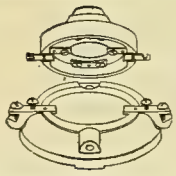

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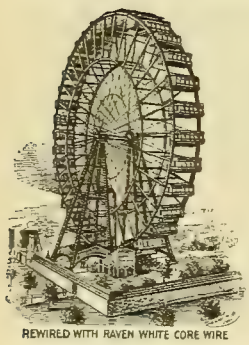

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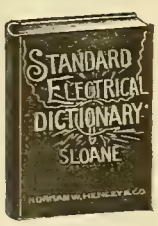

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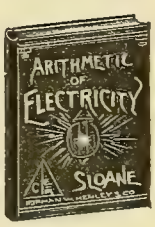

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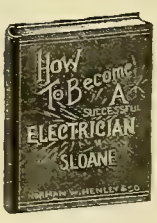

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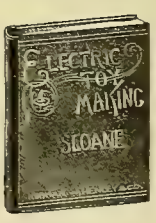

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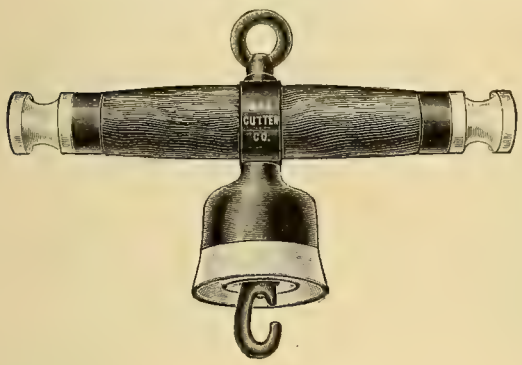

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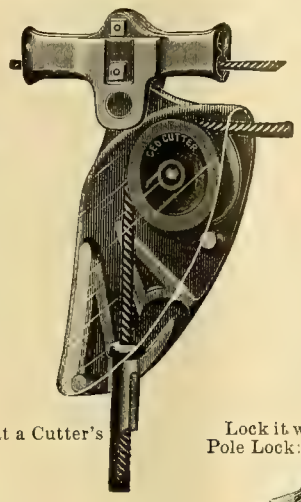

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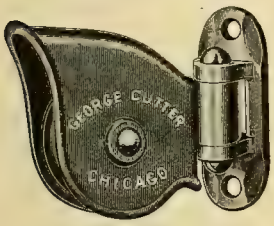

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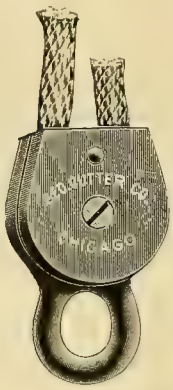

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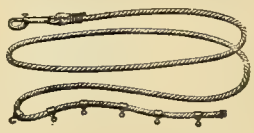

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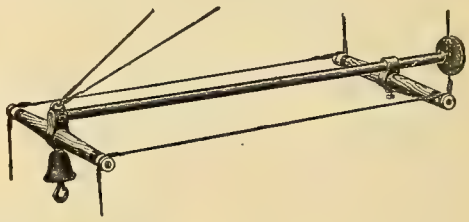

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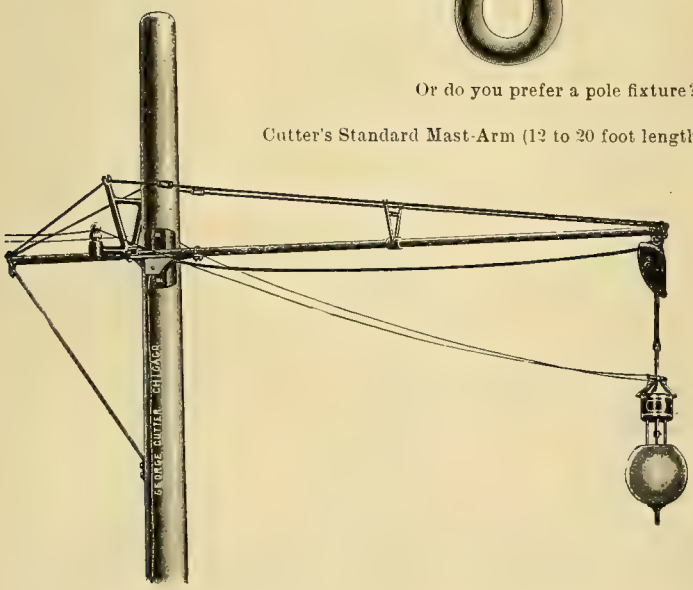

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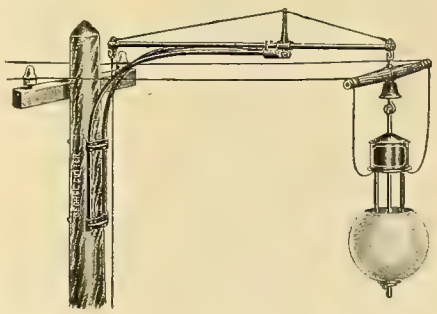

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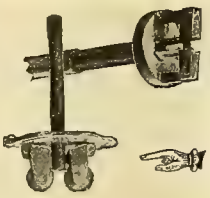

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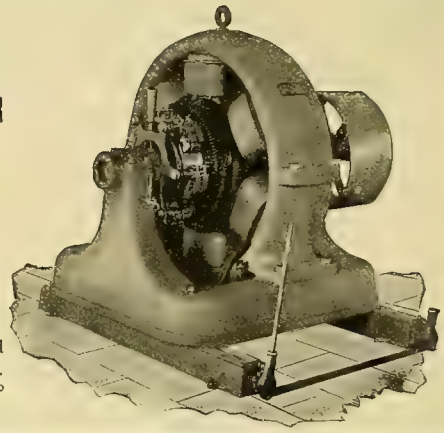

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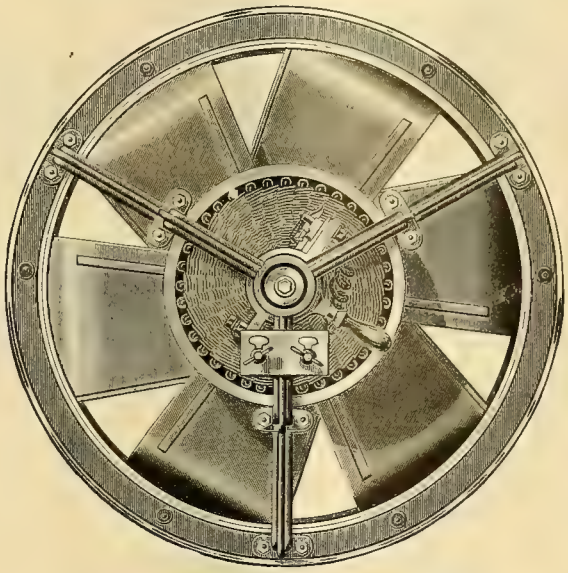

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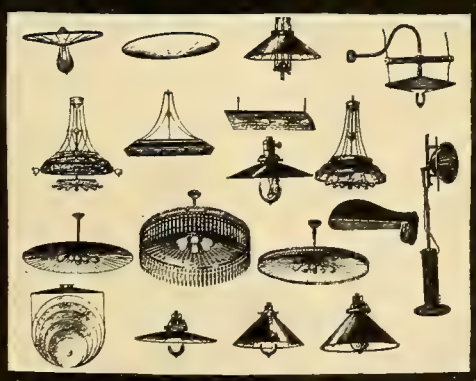

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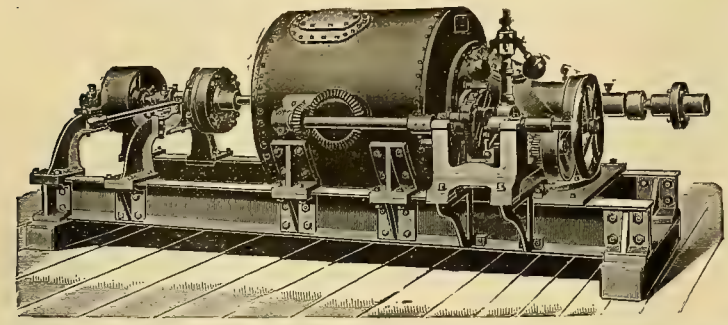

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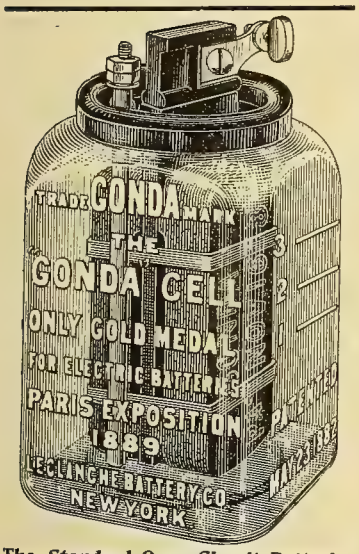

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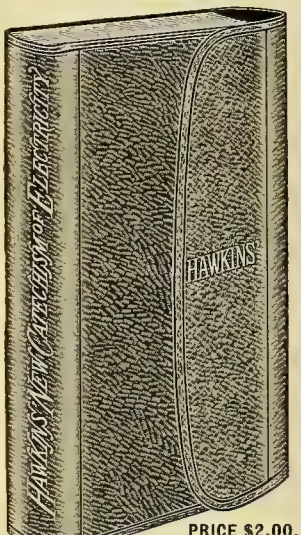

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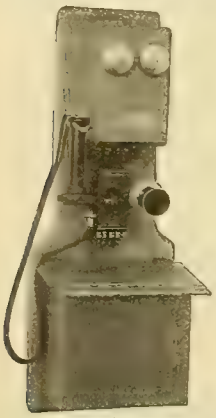

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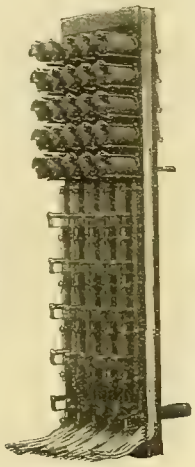

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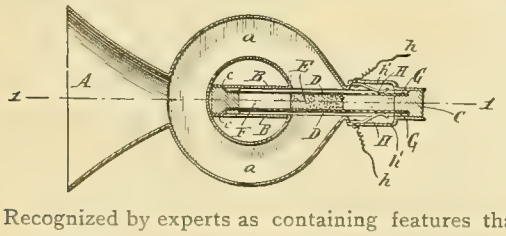

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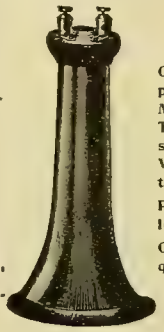

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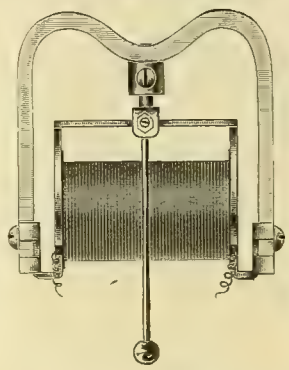

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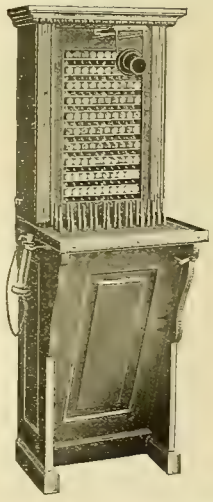

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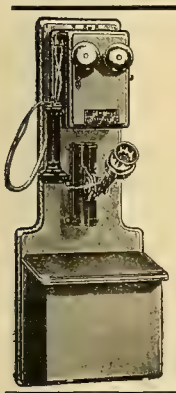

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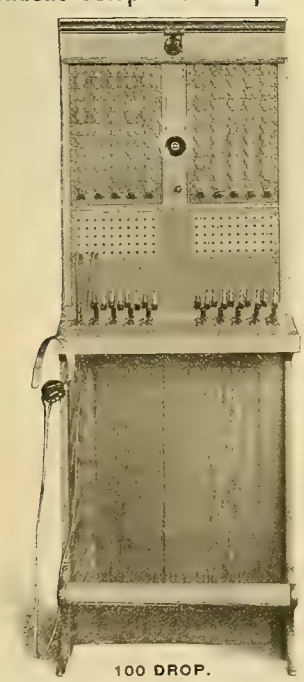

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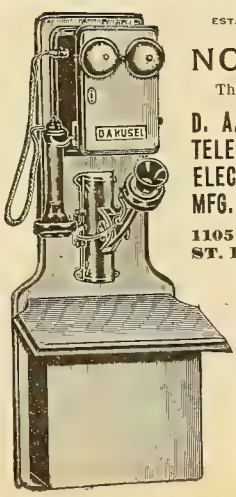

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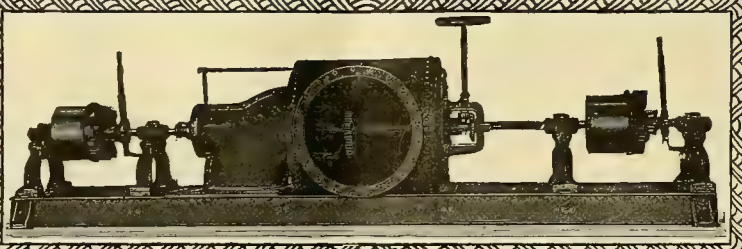

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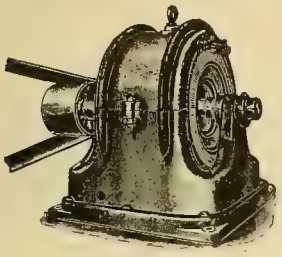

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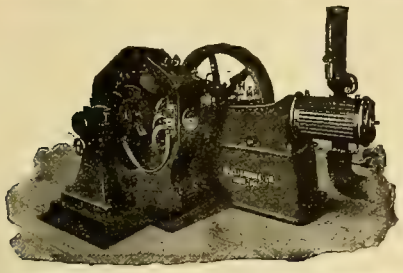

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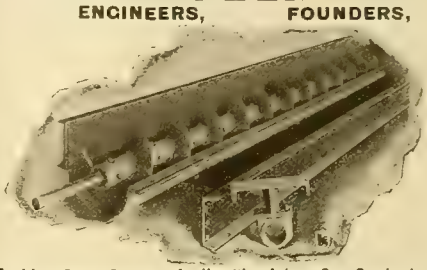

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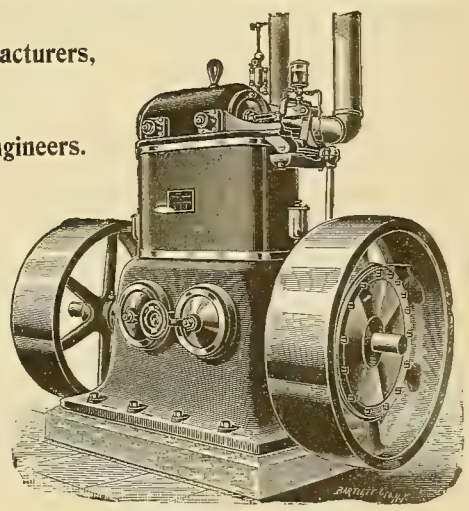

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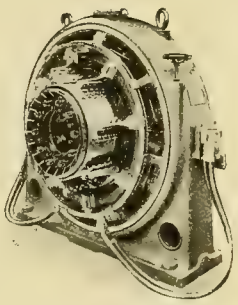

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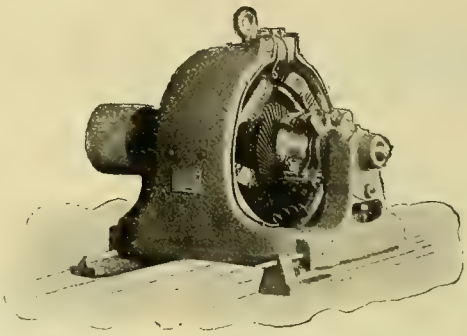

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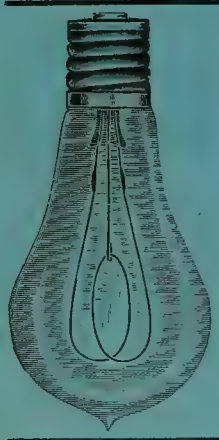

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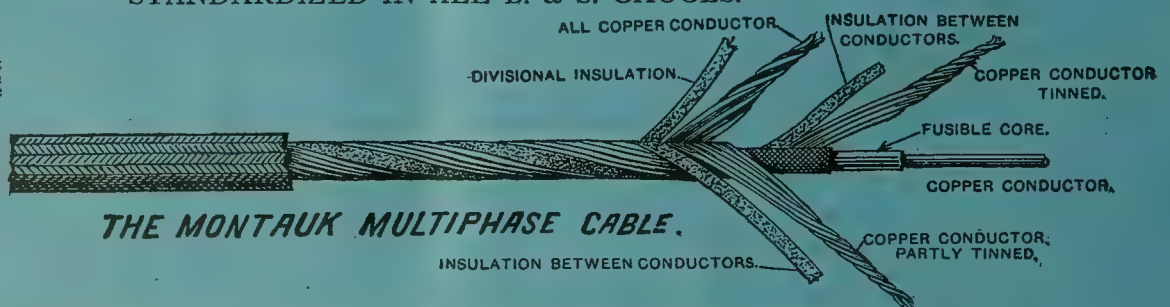

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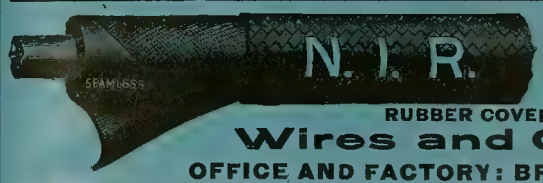

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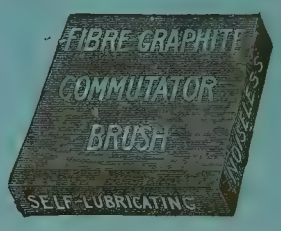

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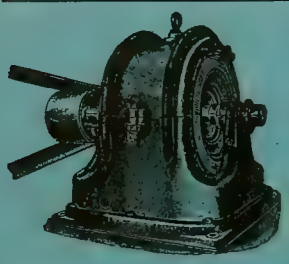

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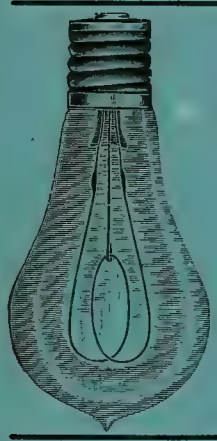

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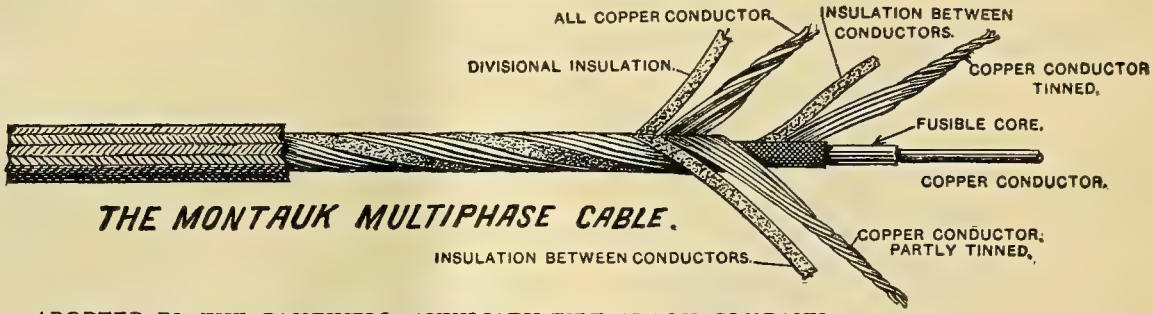

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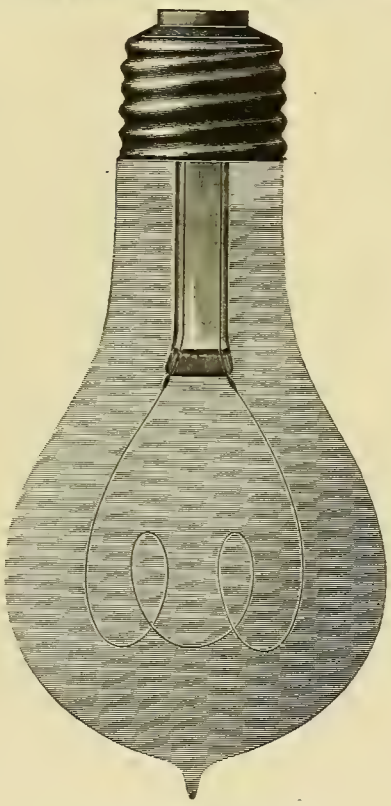

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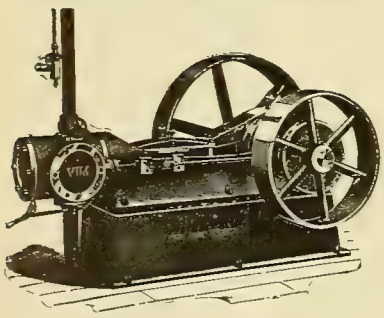

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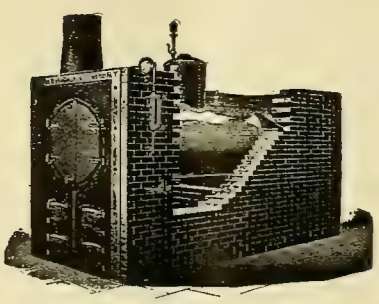

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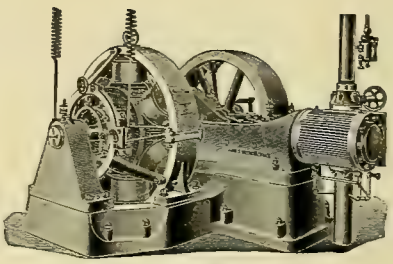

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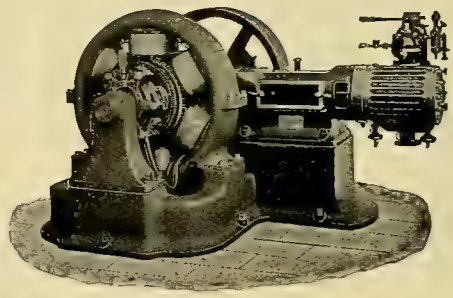

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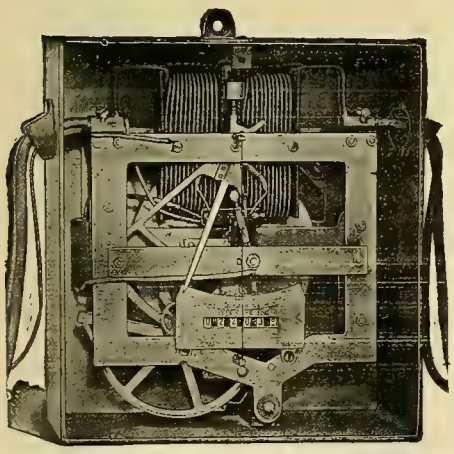

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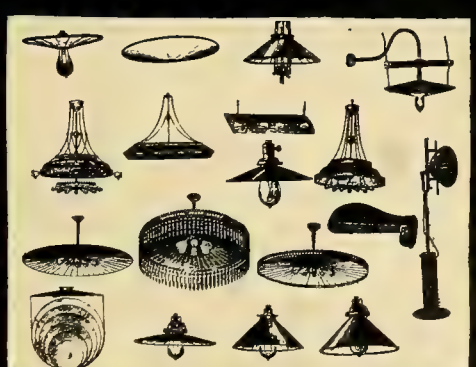

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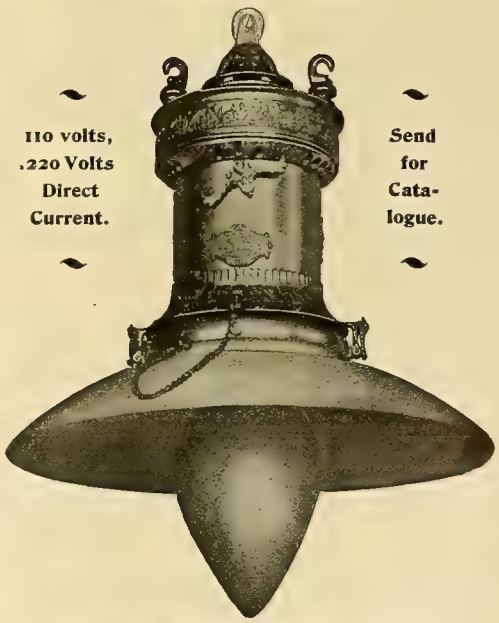

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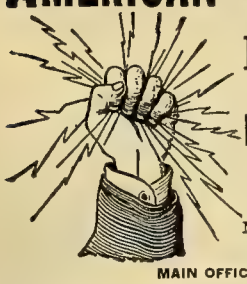

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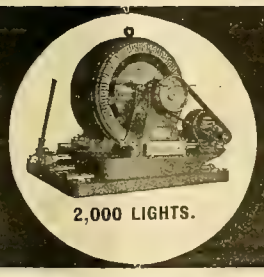

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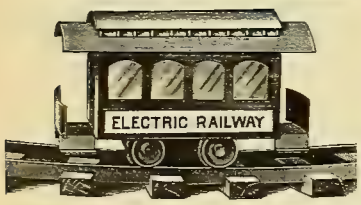

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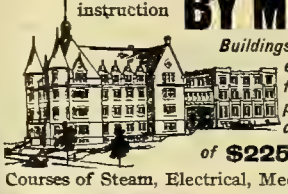

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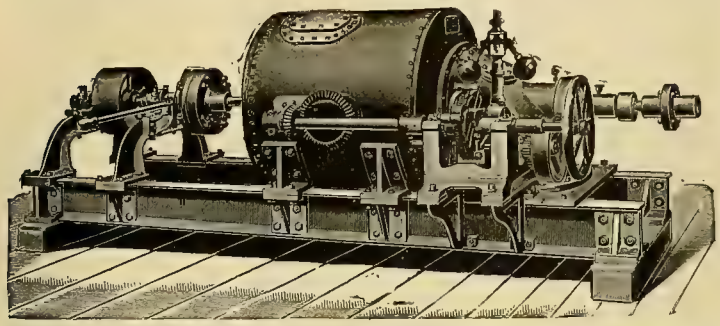

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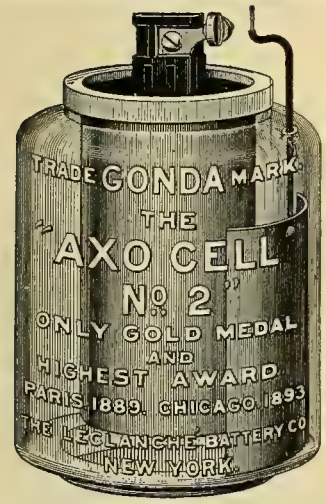

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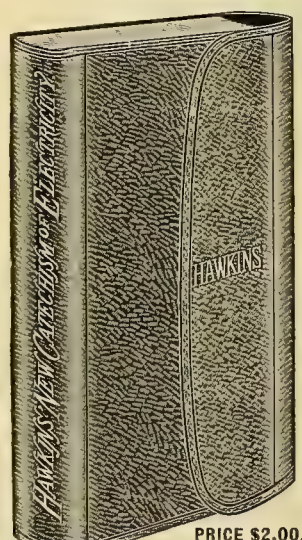

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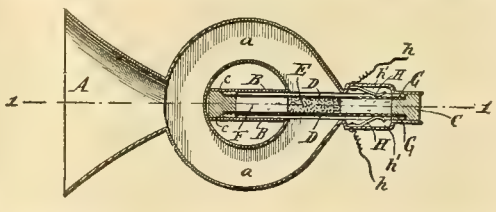

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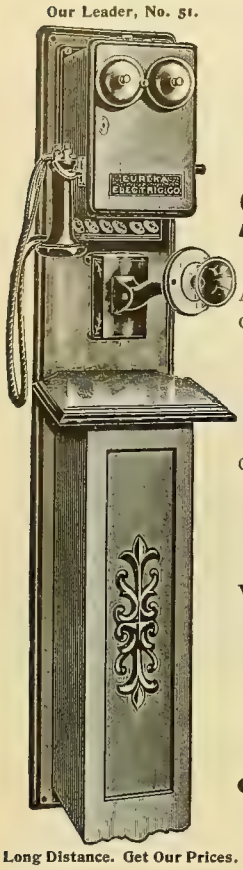

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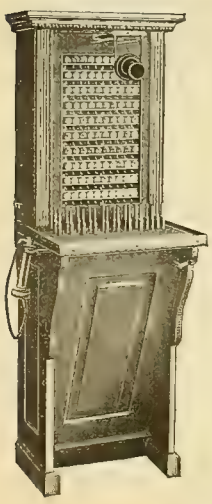

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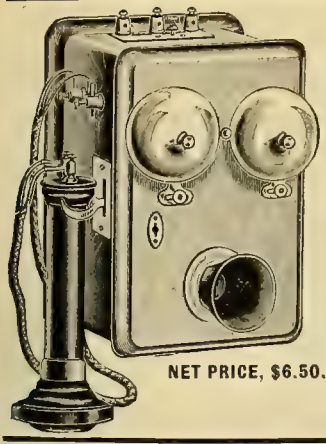

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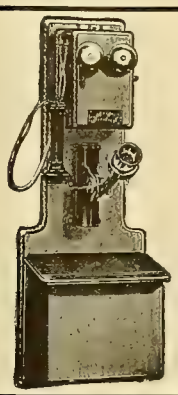

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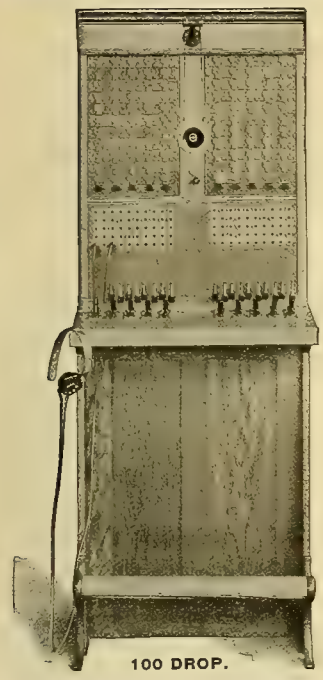

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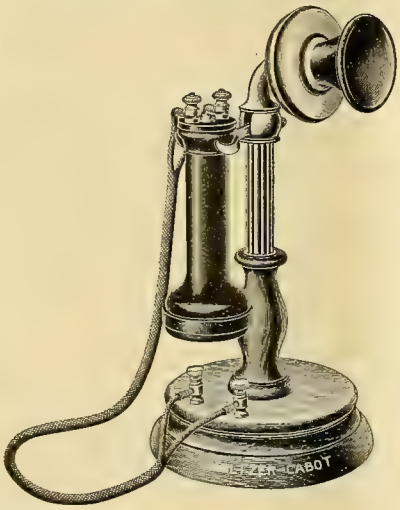

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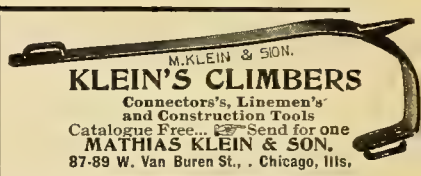

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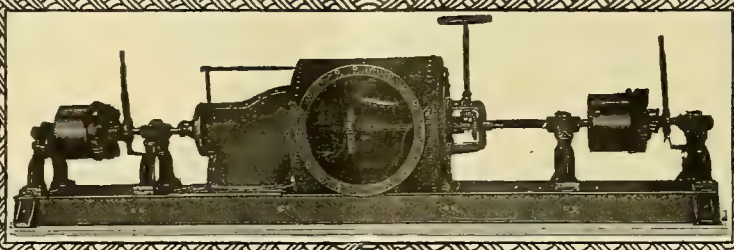

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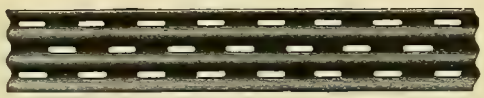

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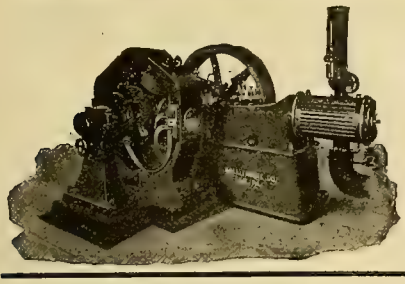

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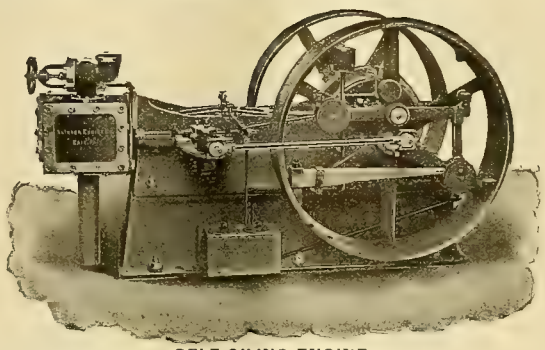

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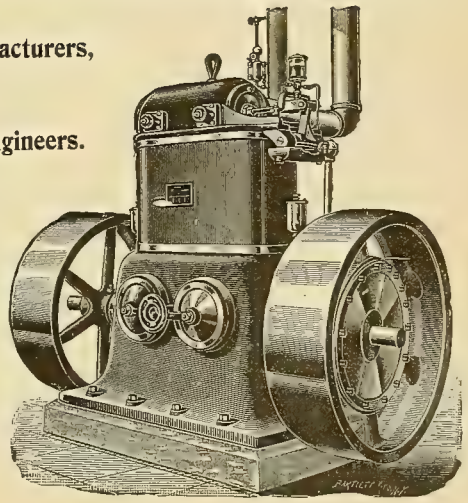

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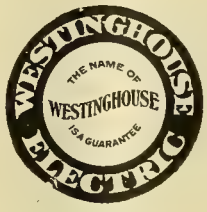

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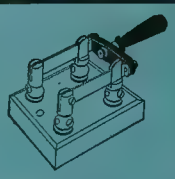

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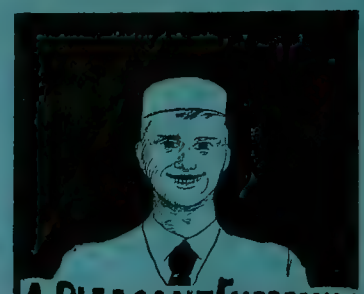

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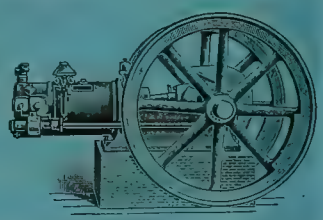

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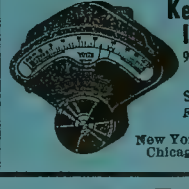
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United Traction Co., Pittsburg, Pa.
Central Railway Co., Baltimore, Md.
Brunswick Traction Co., 1st battery, New Brunswick, N. J.
Brunswick Traction Co., 2d battery, New Brunswick, N. J.
Rochester Railway Co., being installed.
Woonsocket Electric Machine & Power Co., Woonsocket, R. I.
Potomac Electric Power Co., Washington, D. C.
Easton Company, Easton, Pa.
Barre & Montpelier Electric Railway Co., Barre, Vt.
Union Street Railway Co., Framingham, Mass.
Electric Light & Power Co., North Abington, Mass.
Union Railway Co., Pawtucket, R. I.
Electric Railway Light & Power Co., Anaconda, Montana.
Merrill Railway & Lighting Co., Merrill, Wis.
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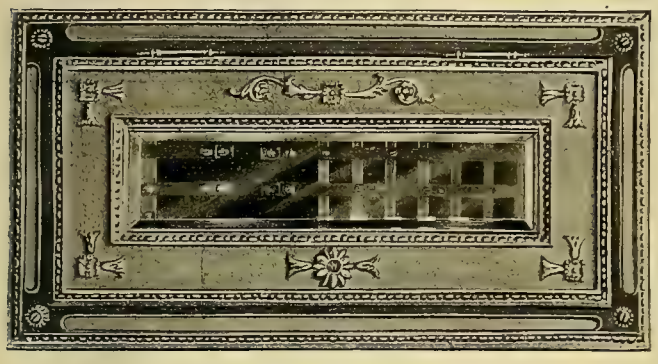

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Automatic Motor Starters. Overload Motor Starters.
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REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

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ENCLOSED ARC LAMPS ARE THE

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150—HOURS—150

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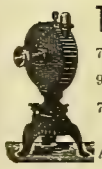

THE ONLY WATER MOTOR which can be adjusted or tilted in any direction while running.
Patented June 28, 1898.

7 in. diameter, 2¼ lb.; brass turned balance wheel and pulley. Price..... $13.60 SPOT CASH.
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Automatic Time Switches

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ELECTRIC LIGHTS and POWER CIRCUITS.

Entirely Automatic and Absolutely Reliable. Also

ARC CUT-OUTS for High Tension Arc Circuits. The BEST APPLIANCES of the Kind are Manufactured by

THE CLEVELAND ELECTRIC CO.,

Corner High and Middle Sts., CLEVELAND, O.

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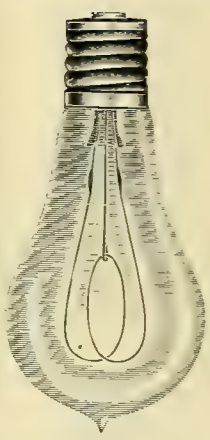

DON'T WORRY

ALL WINTER, WONDERING IF YOU ARE GETTING YOUR MONEY'S WORTH OF LIGHT.

BUY BEACONS,

AND REST CONTENT; YOU WILL BE PROTECTED BY OUR GUARANTEE OF AN AVERAGE MAINTENANCE OF INITIAL C.P. AT STANDARD EFFICIENCY FOR OVER 300 HOURS AND AN AVERAGE LIFE OF OVER 600 HOURS.
MULTIPLE, SERIES FOR ALL CIRCUITS, MINIATURES, ETC.

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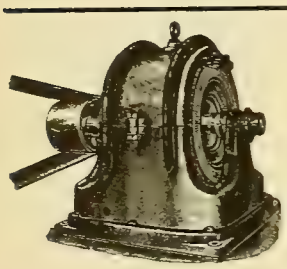

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P. S.—We remove every trace of oil from leather belting without injury to leather or cement. We then treat it with Amber Leather Preserver, which renders it oil, water and steam proof.

LEATHER PRESERVER MFG. CORP.

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Western Elect. Supply Co.

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Chicago Edison Co.
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National Carbon Co.
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Standard Brass Works.

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Farr Tel. & Cons. Sup. Co.
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Cleveland Electric Co.
Commercial El. Supply Co.
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LaRoche & Co., F. A.
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Peru Elec. Mfg. Co.
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Western Electric Co.
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Westinghouse El. & Mfg. Co.

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Crocker-Wheeler Elec. Co.
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Western Elect. Supply Co.
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Broomell, Schmidt & Co.
Fuel Economizer Co

Elec. Heat'g Appliances.
American Elec. Heater Co.

Electric Meters.
American El. Meter Co.

Electric Railways.
General Electric Co.
Walker Company.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
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Lemon, L. E.
Sargent & Lundy.

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Central Electric Co.
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Commercial El. Supply Co.
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Electric Appliance Co.
General Electric Co.
Illinois Electric Co.
Keystone El. Instrument Co.
Leonard, Ward, Elec. Co.
Paiste Co., H. T.
Queen & Co.
Western Electric Co.
Western Elect. Supply Co.
Weston Electrical Inst. Co.

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Cleveland Electric Co.
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Lea Mfg. Co.
Ohio Elec Specialty Mfg. Co.
Western Elect. Supply Co.

Electro-Magnets.
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Electro-Plating Mach'y.
Besly & Co., Chas. H.
General Electric Co.
Hobart Elec. Mfg. Co.

Engines, Gas.
Otto Gas Engine Wks.

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Ames Iron Works.
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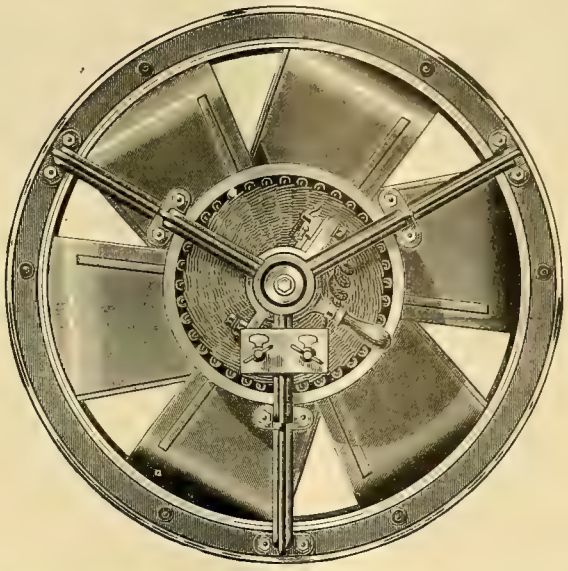

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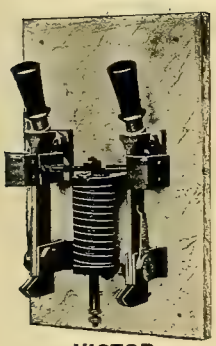

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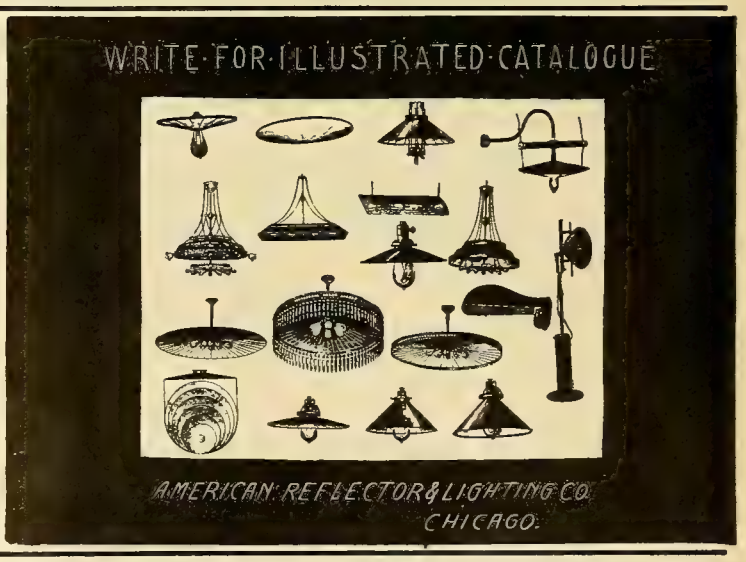

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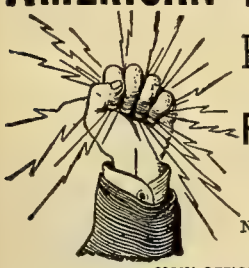

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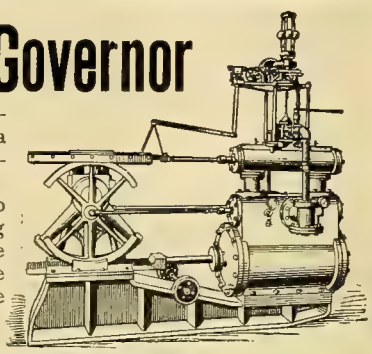

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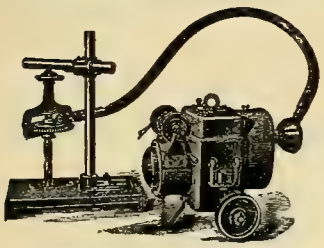

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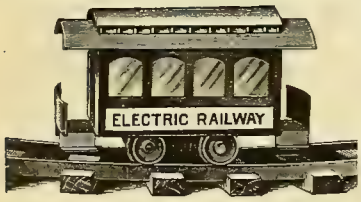

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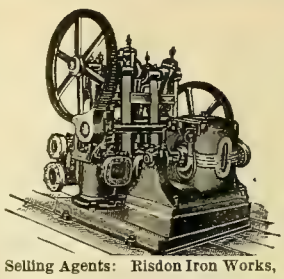

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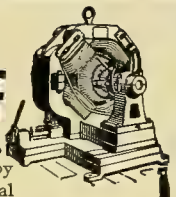

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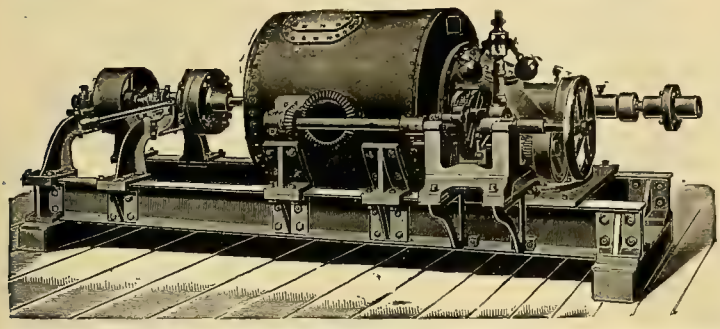

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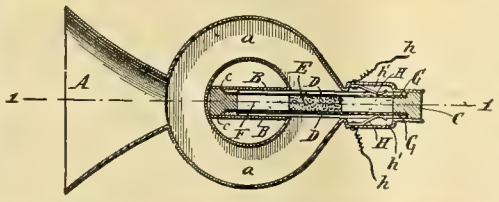

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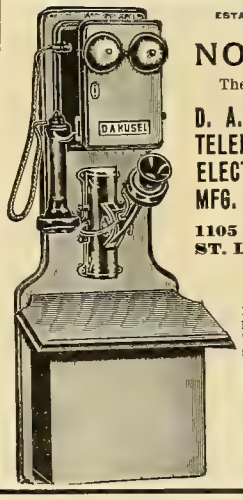

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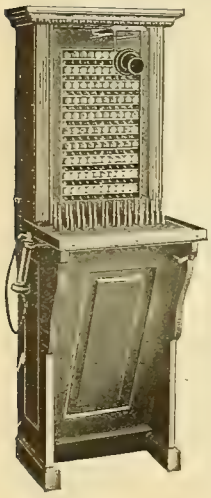

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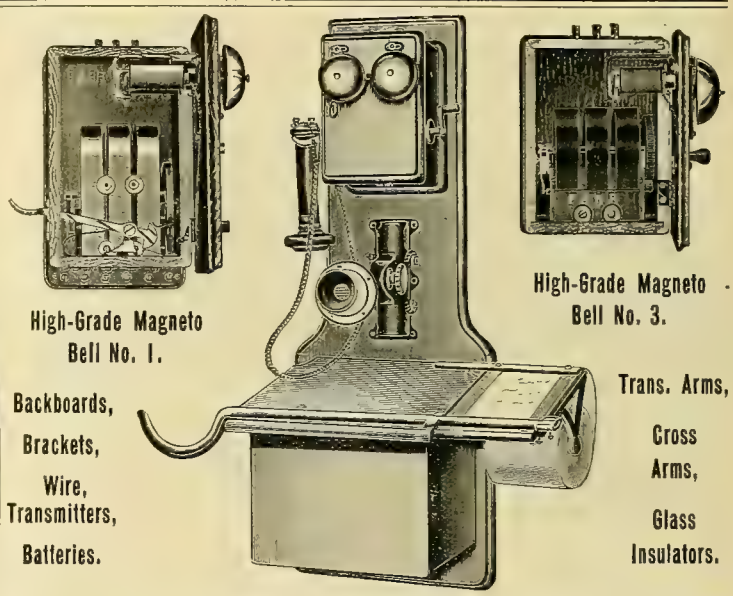

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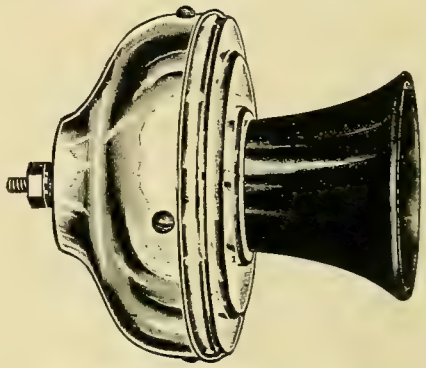

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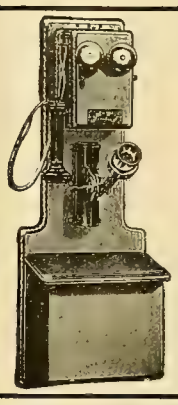

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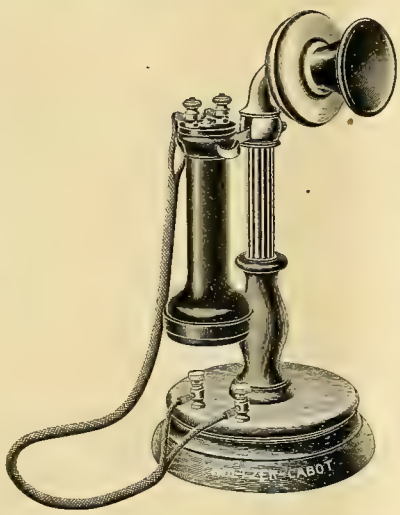

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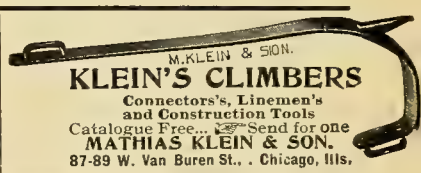

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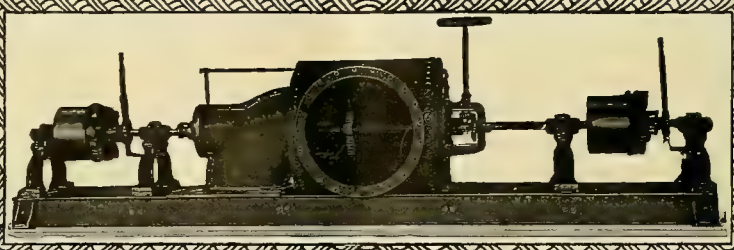

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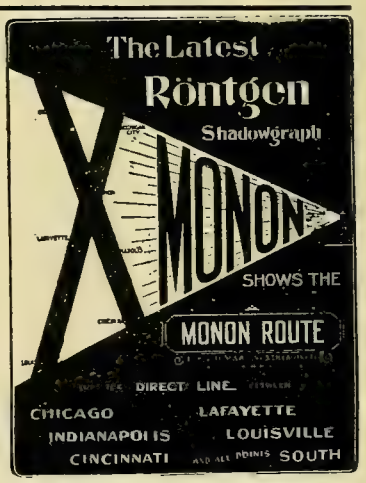

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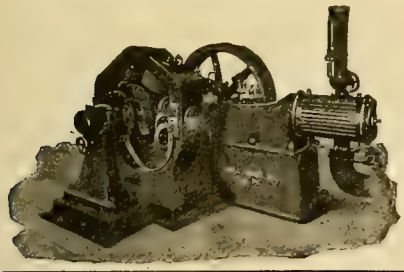

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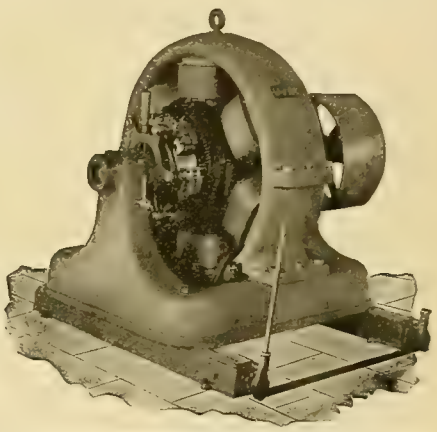

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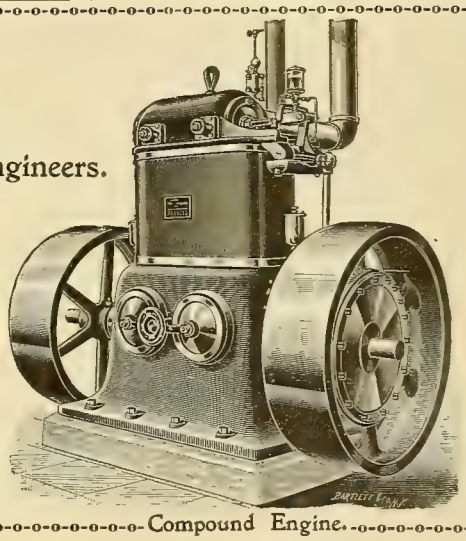

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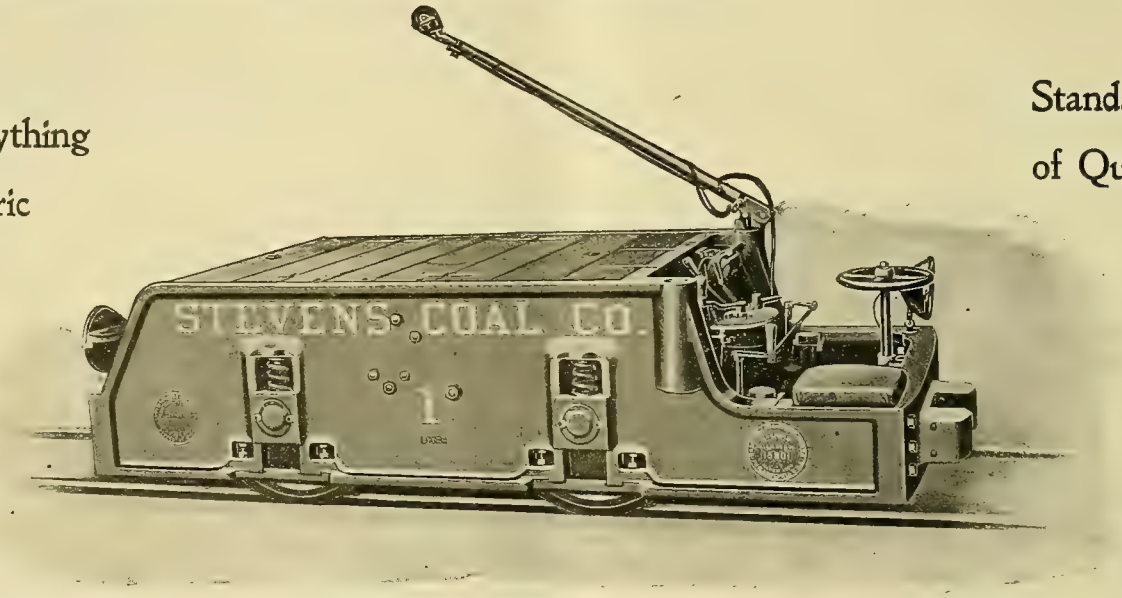

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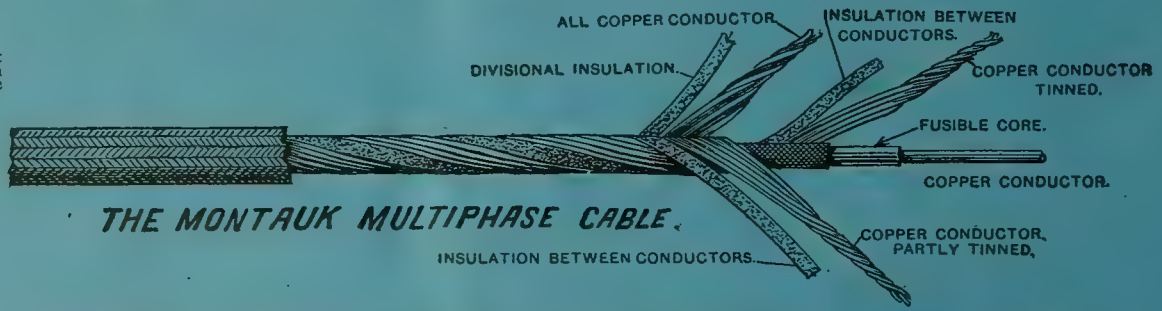

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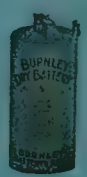

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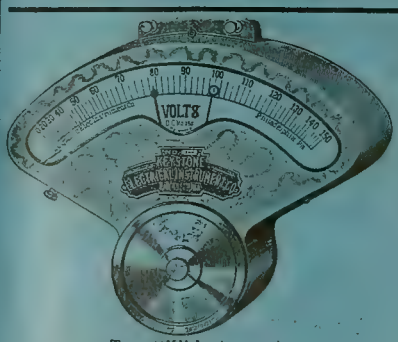

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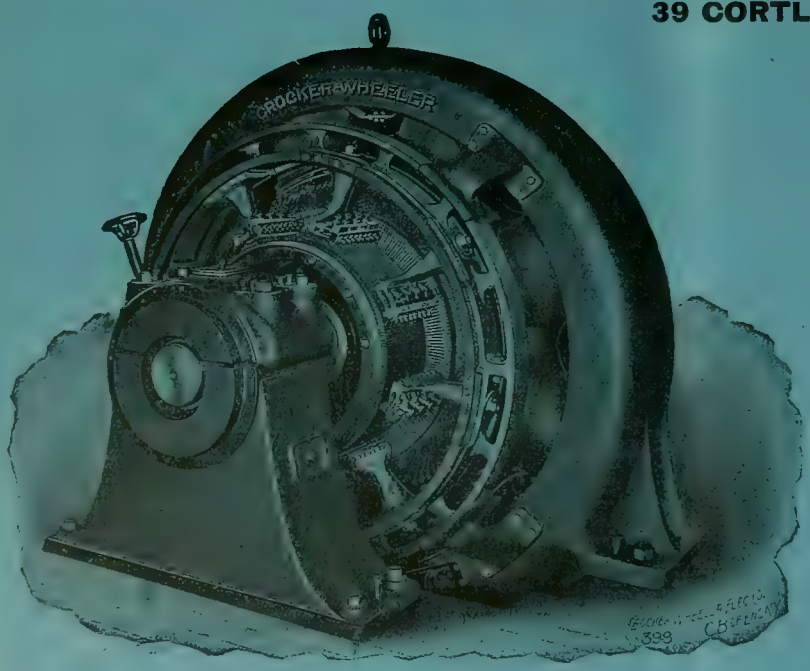

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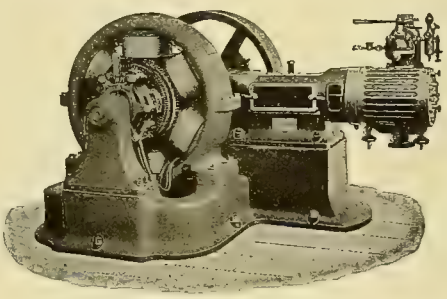

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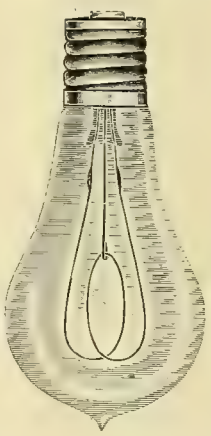

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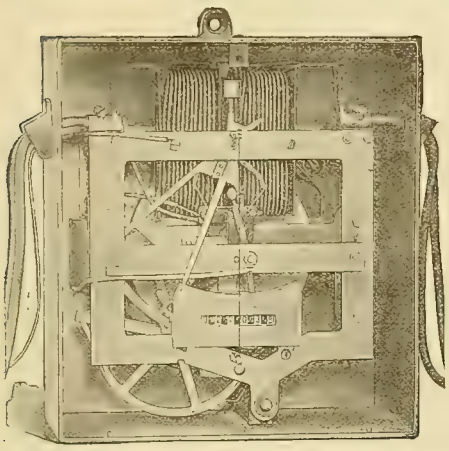

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Tapes, Insulating.
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Commercial El. Supply Co.
Electric Appliance Co.
Illinois Electric Co.
Leschen-Macomber-Whyte Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Washburn & Moen Mfg. Co.
Western Electric Co.
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Telephones, Telephone Material and Switchboards.
Allen-Hussy Co.
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Cabinet Mfg. Co.
Commercial El. Supply Co
Eureka Electric Co.
Farr Tel. & Cons. Sup. Co.
Fisk, H. M., Mfg. Co.
Holtzer-Cabot Electric Co.
Insull, Martin J.
Keystone Tel. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel, D. A. Tel. & El. Mfg. Co.
Manhattan Elec. Sup. Co.
Rawson Electric Co.
St. Louis El. Supply Co.
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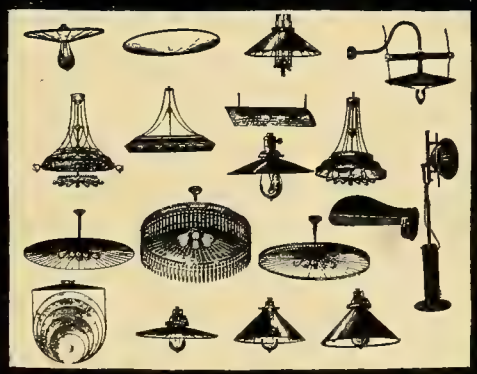

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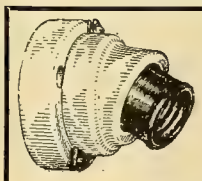
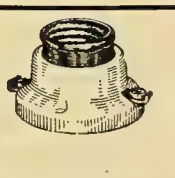
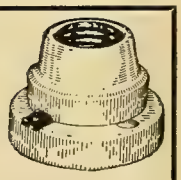

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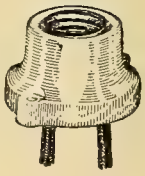

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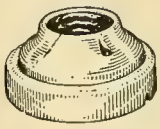
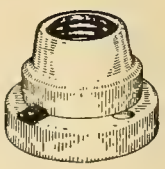

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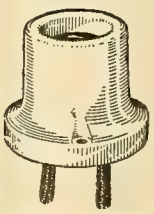
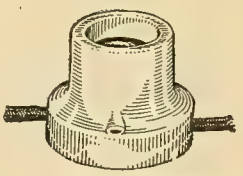

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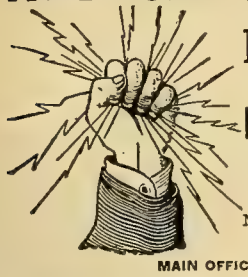

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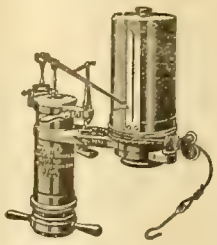

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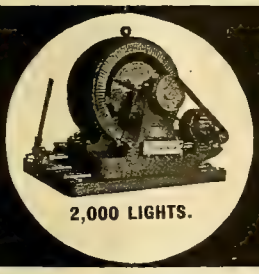

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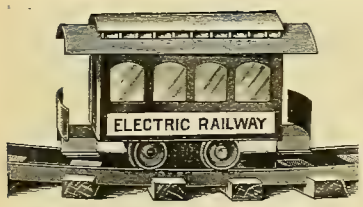

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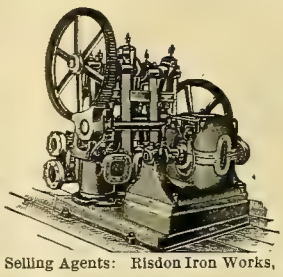

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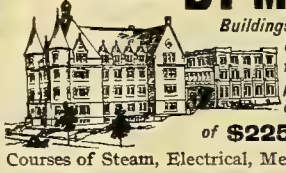

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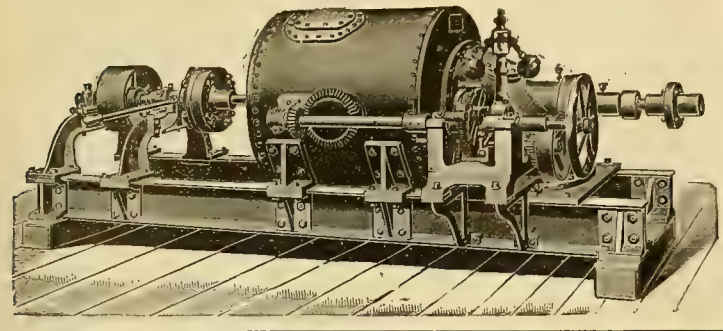

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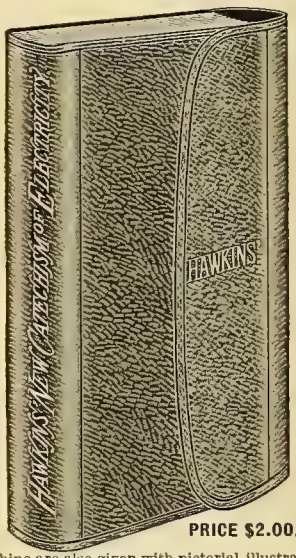

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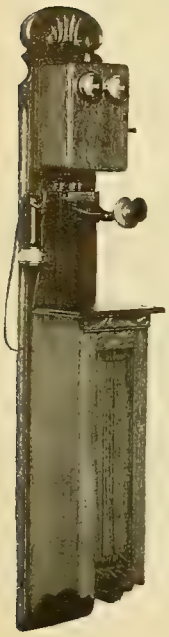

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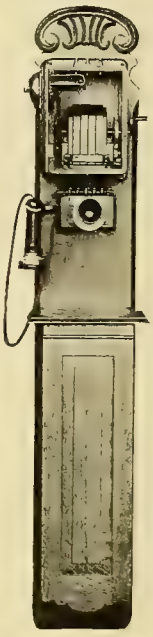

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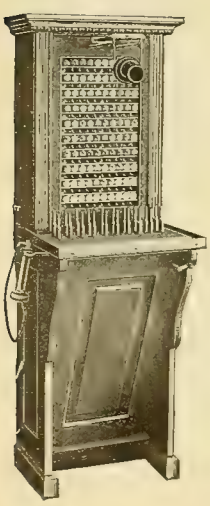

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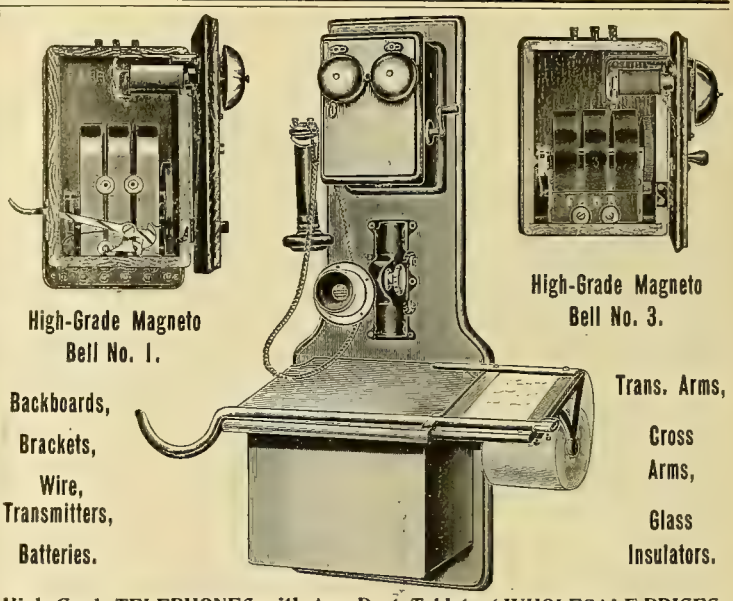

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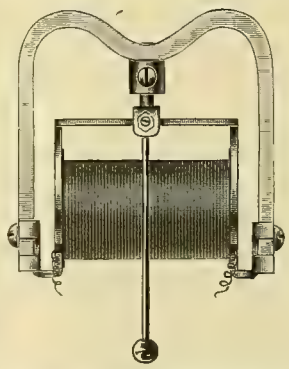

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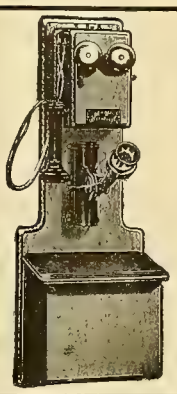

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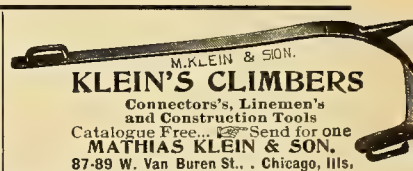

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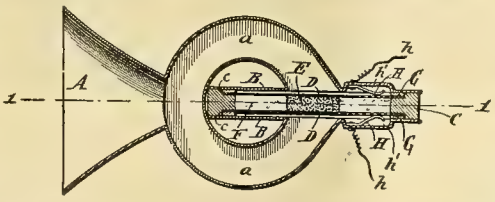

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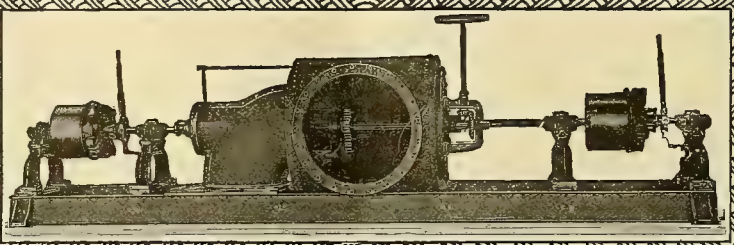

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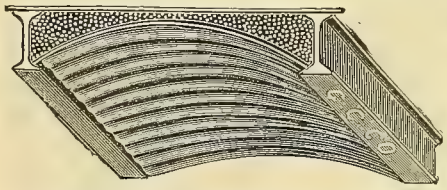

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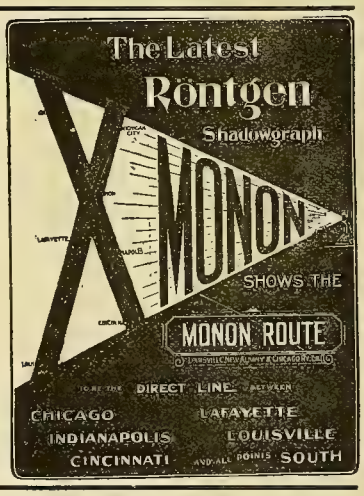

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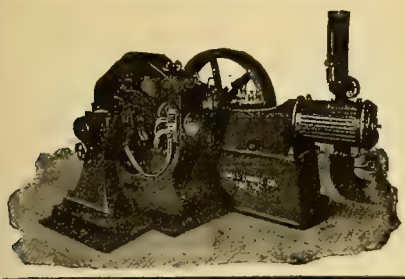

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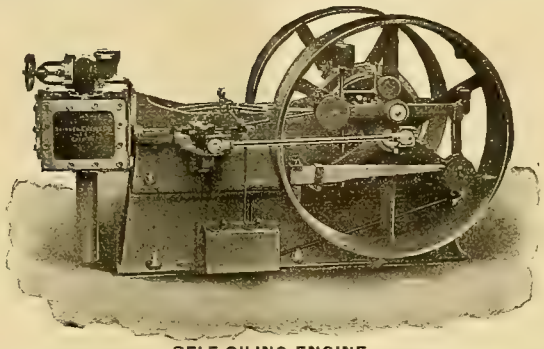

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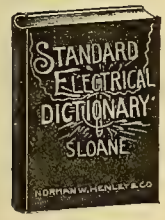

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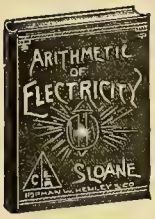

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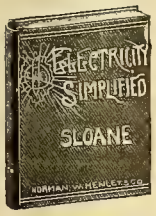

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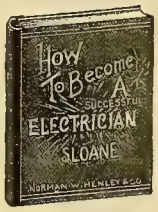

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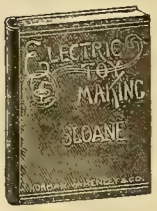

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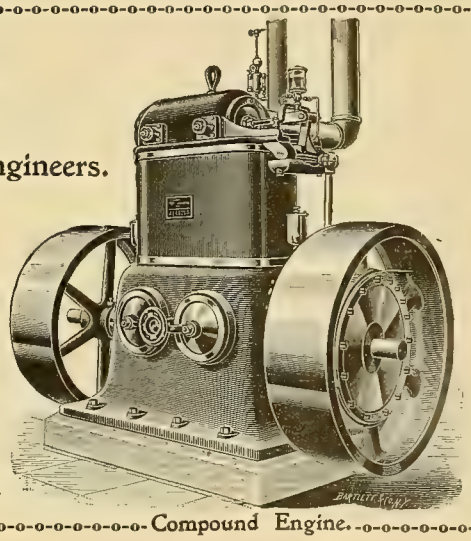

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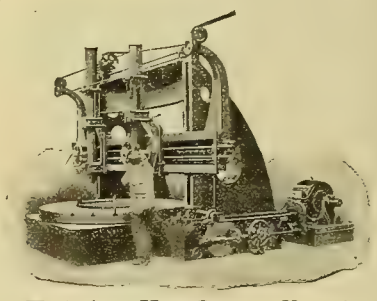

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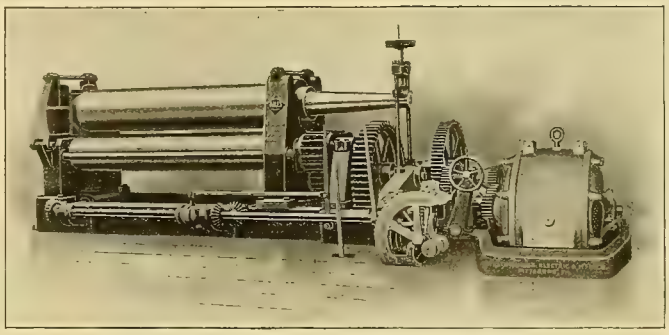

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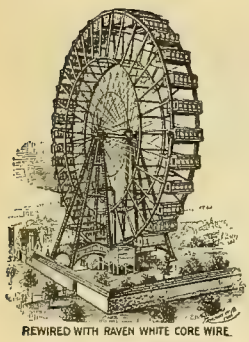

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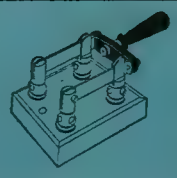

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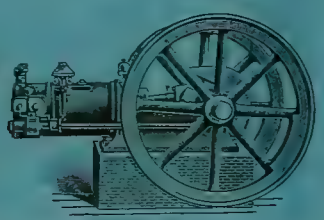

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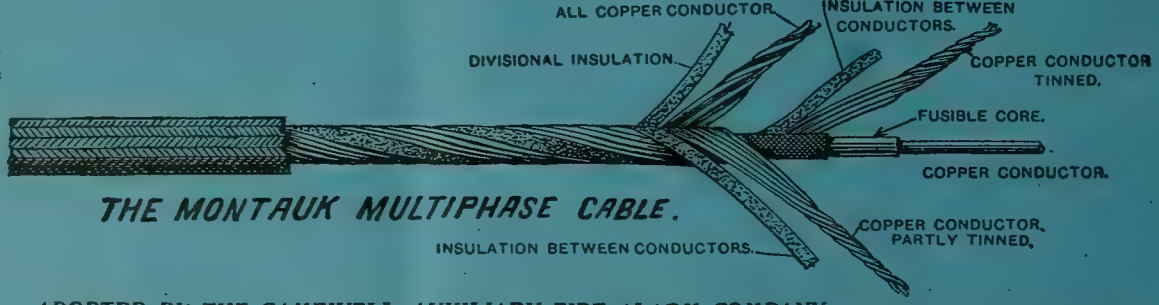

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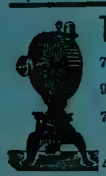
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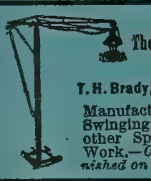
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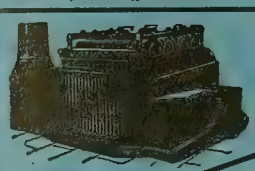
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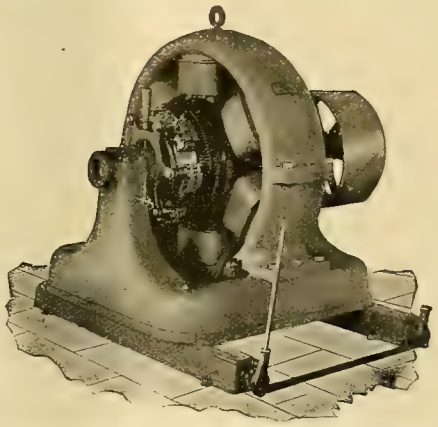

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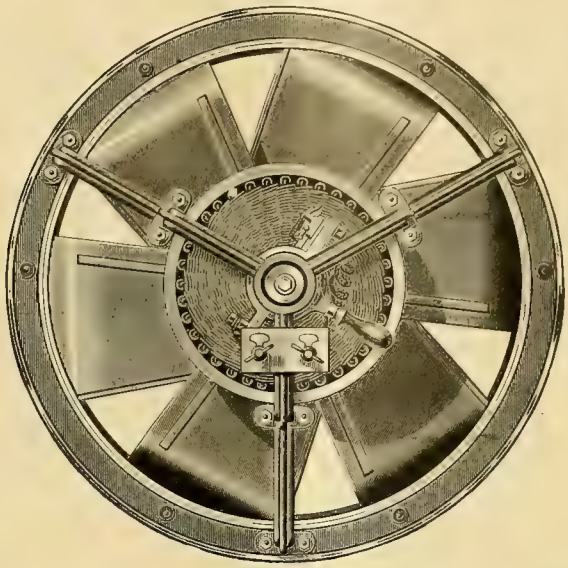

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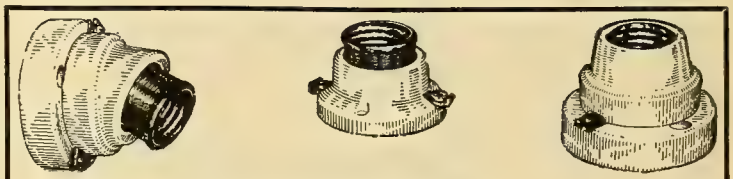

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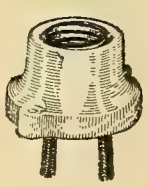

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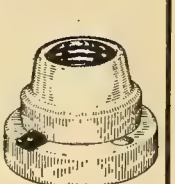

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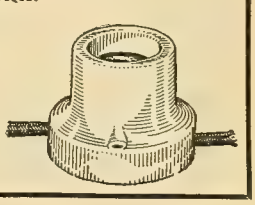

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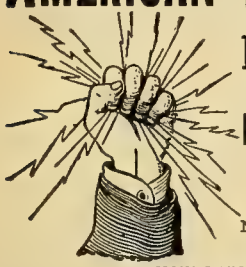

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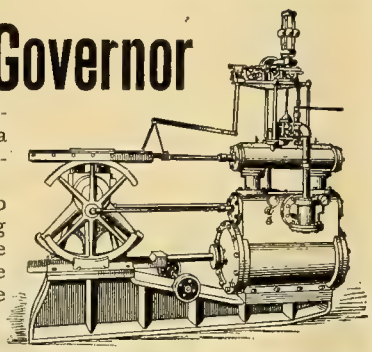

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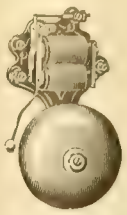

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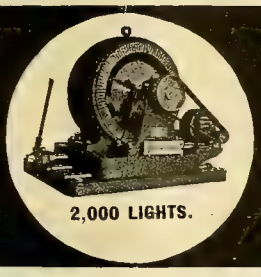

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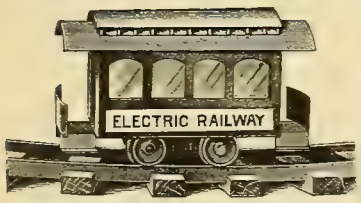

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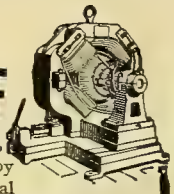

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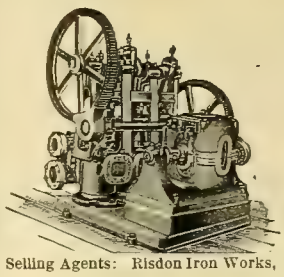

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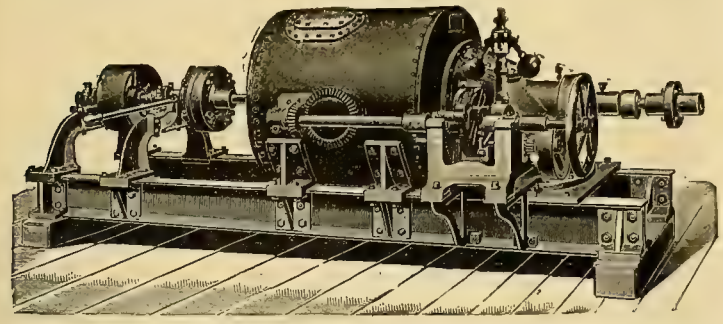

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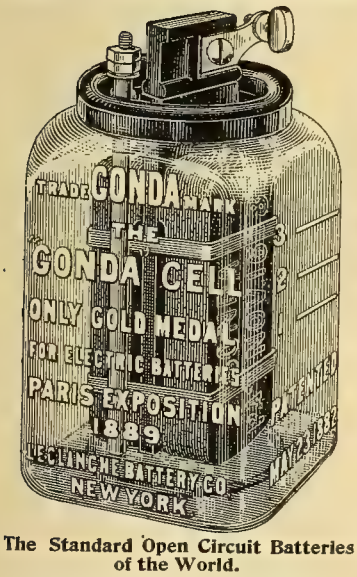

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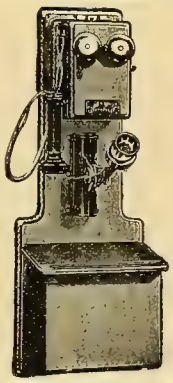

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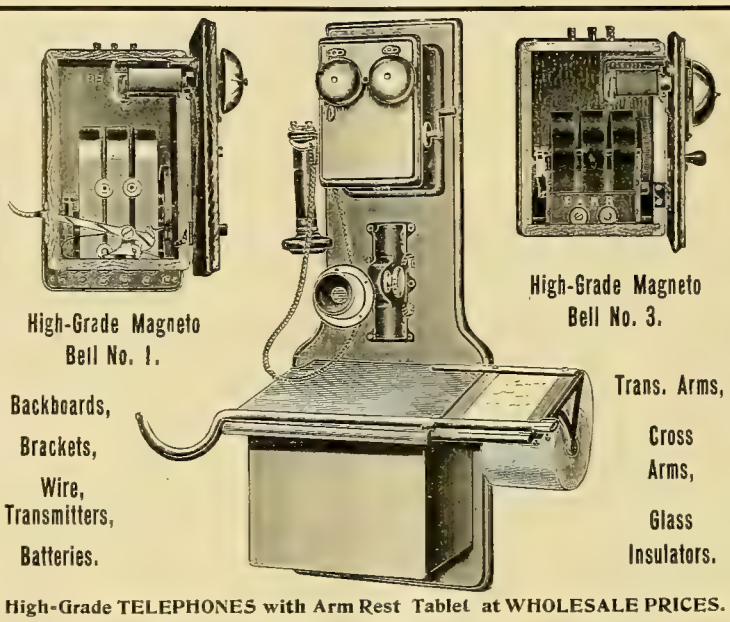

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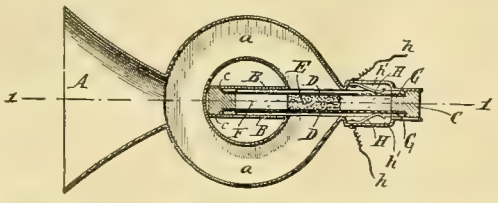

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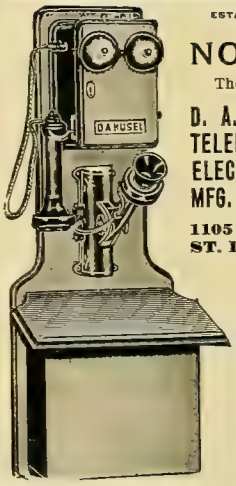

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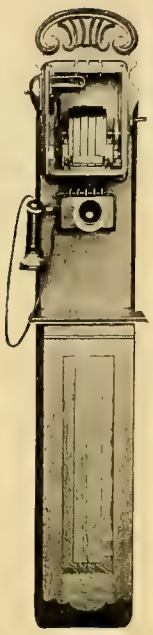

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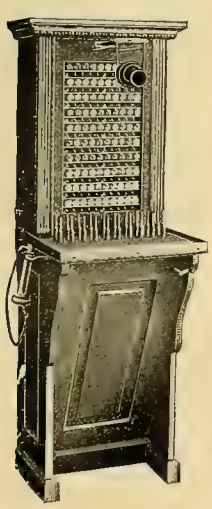

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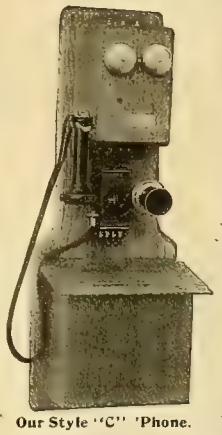

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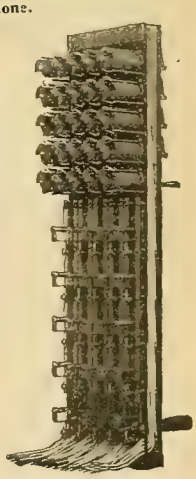

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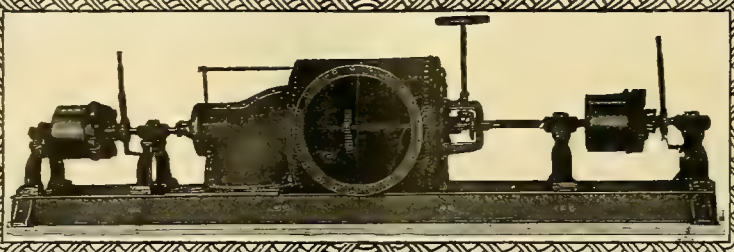

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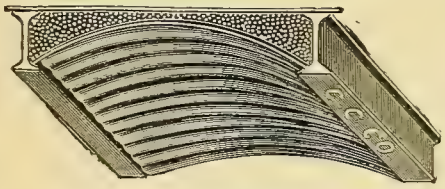

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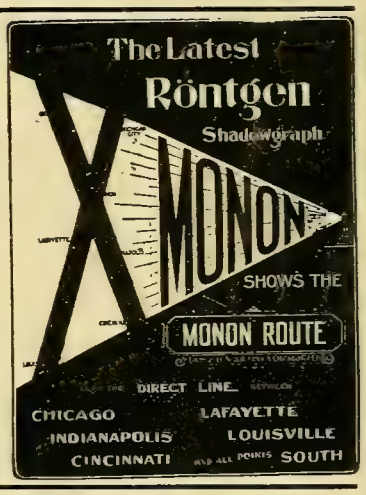

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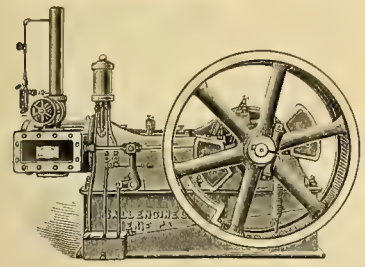

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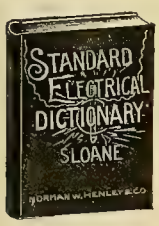

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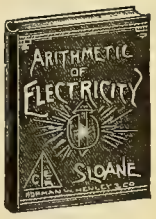

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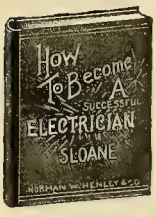

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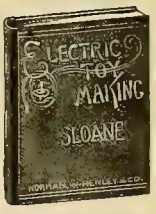

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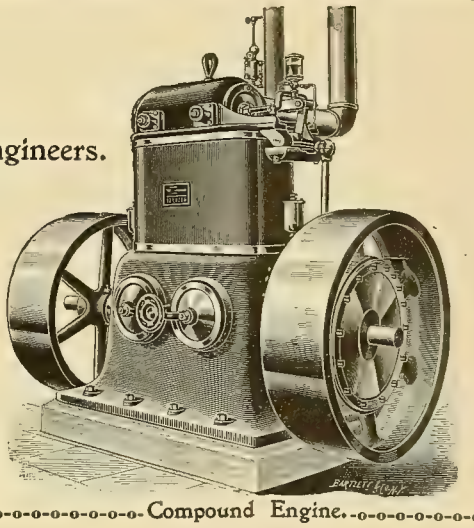

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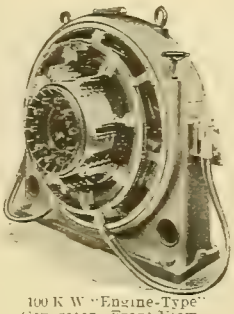

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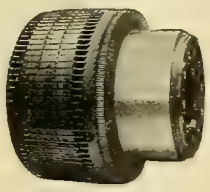

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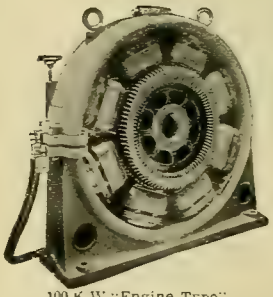

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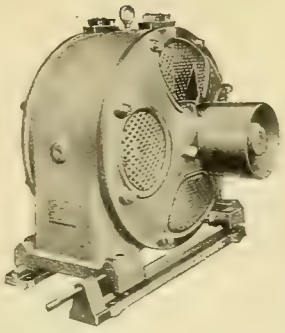

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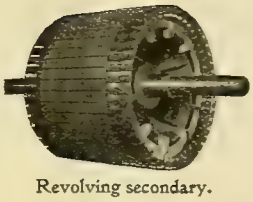

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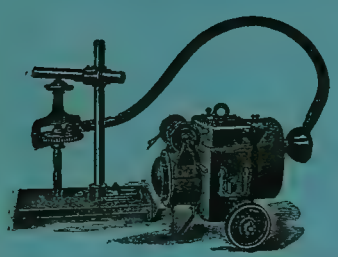

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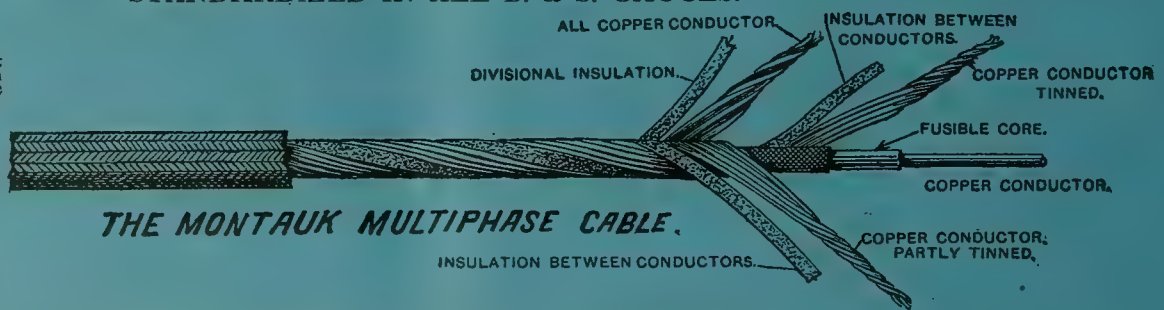

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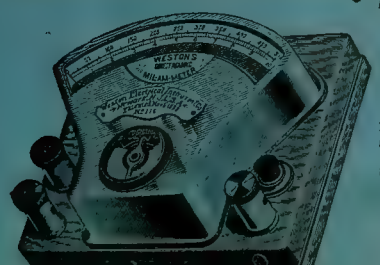

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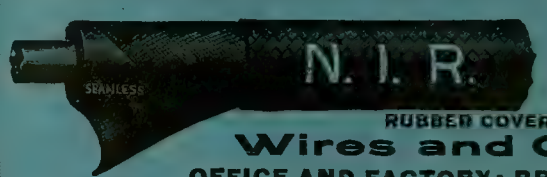

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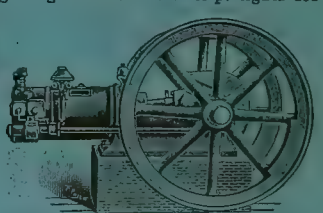

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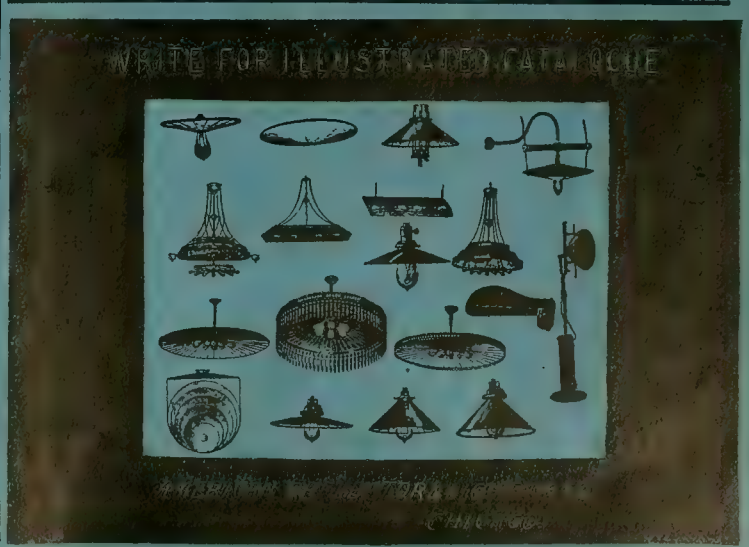

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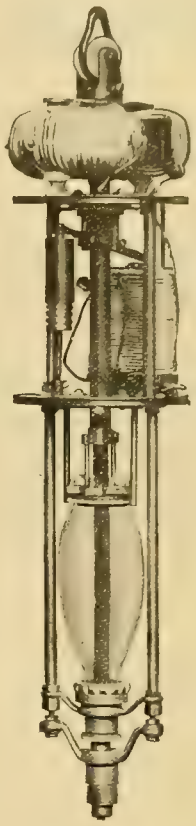

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We have the Largest and Most Complete Electrical

REPAIR SHOPS

In the West. **ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.**

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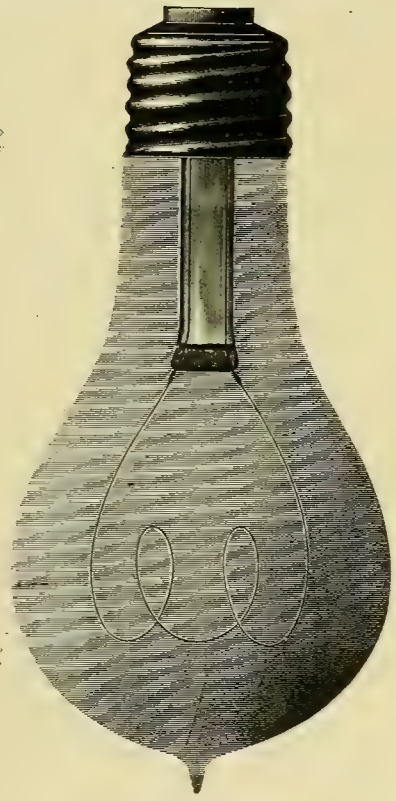

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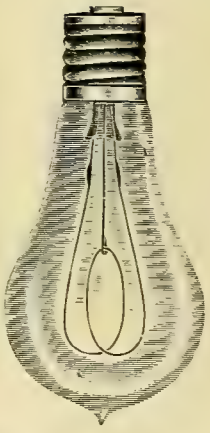

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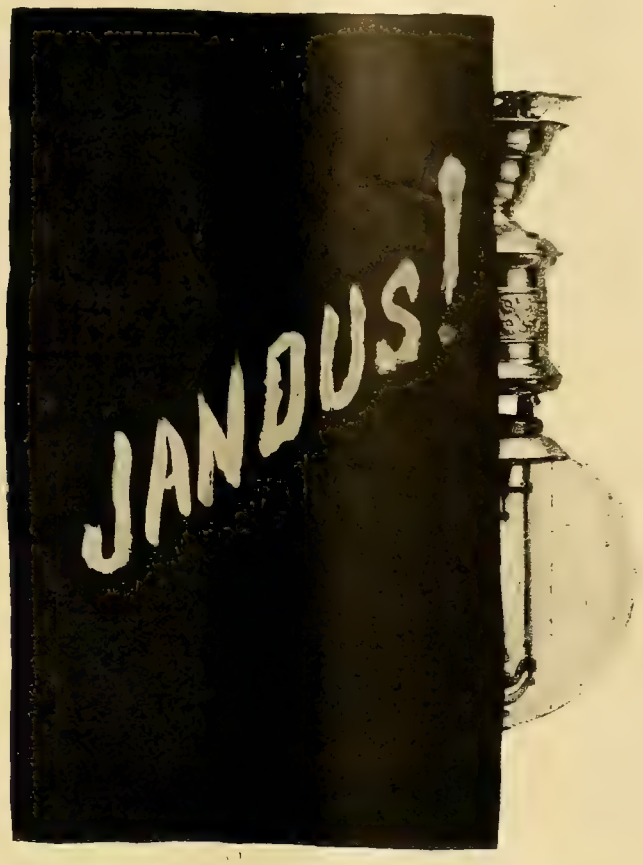

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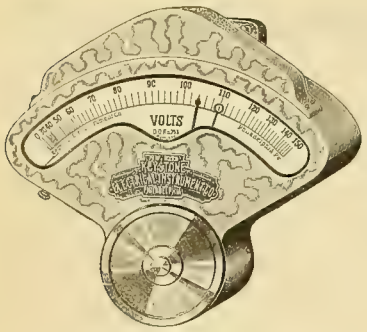

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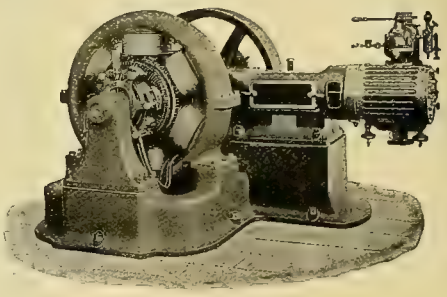

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Engines, Steam.
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Okonite Co., The.
Phillips Insulated Wire Co.
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Illinois Electric Co.
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For Alphabetical Index of Advertisements See Page III.

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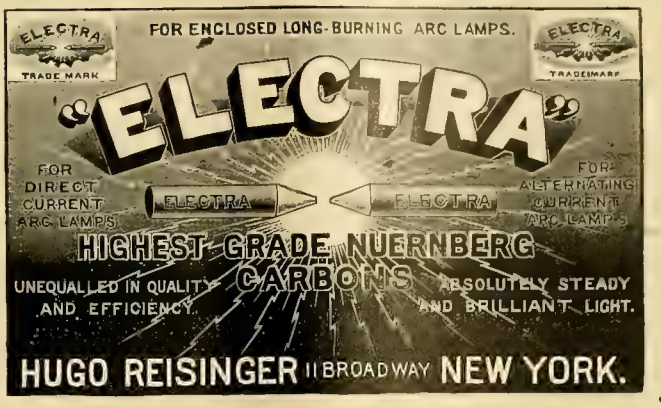

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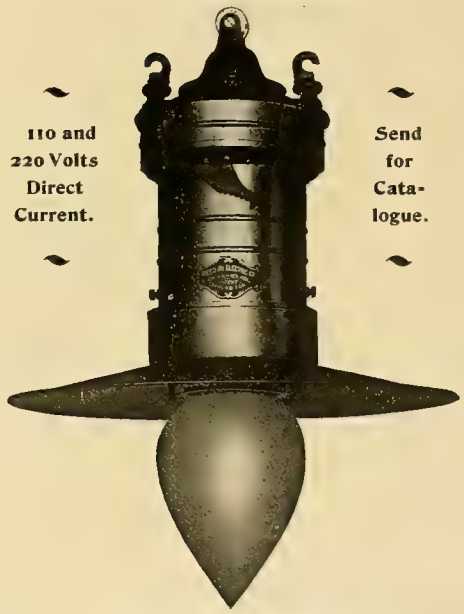

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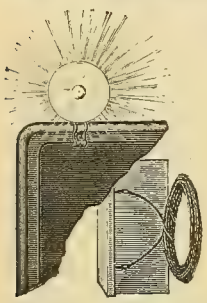

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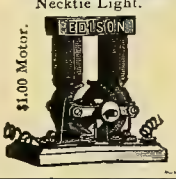

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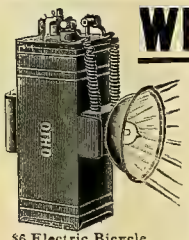

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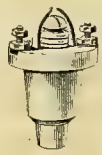

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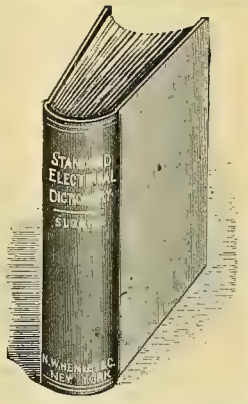

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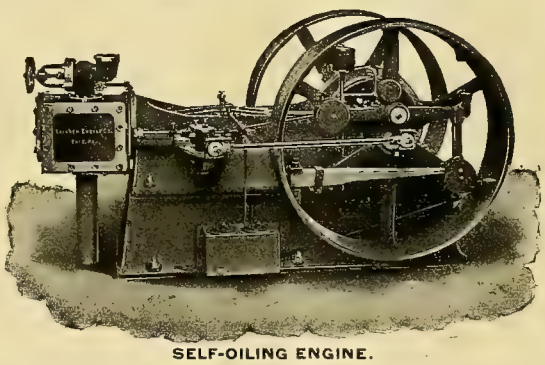

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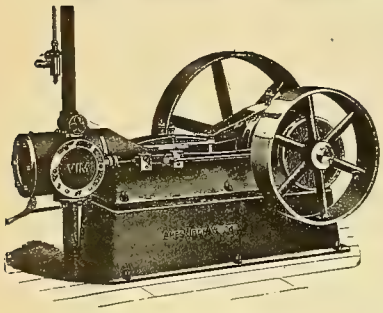

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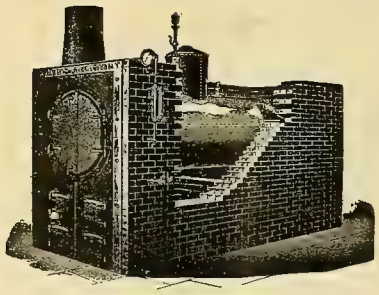

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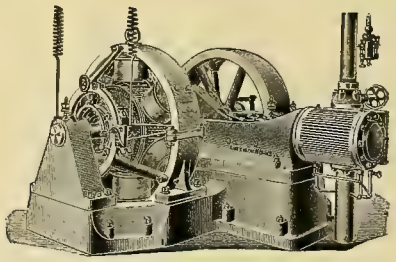

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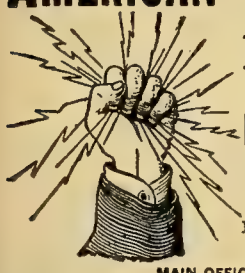

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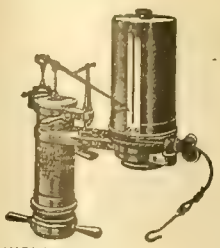

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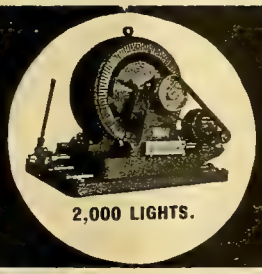

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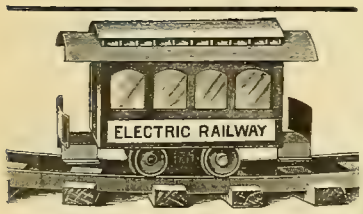

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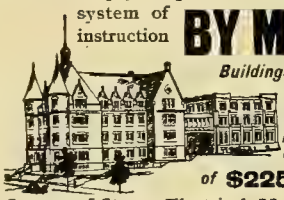

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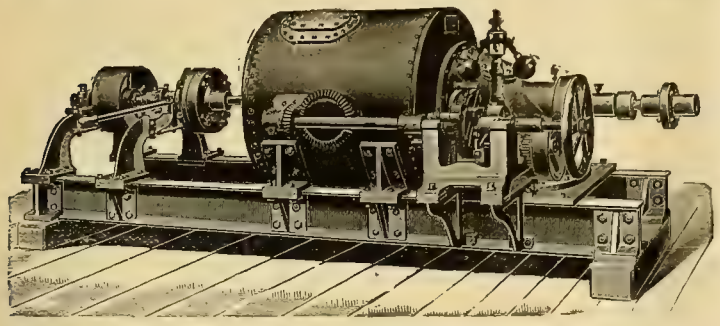

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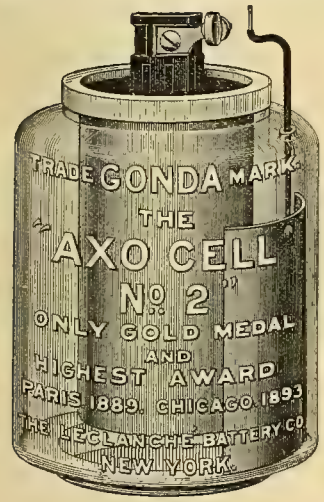

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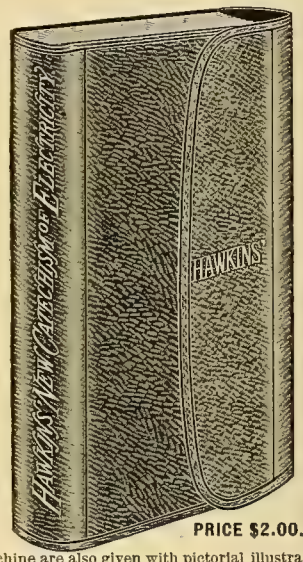

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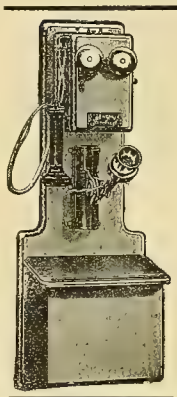

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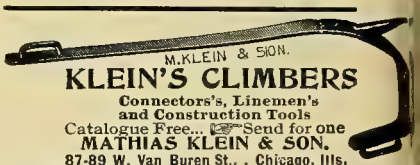

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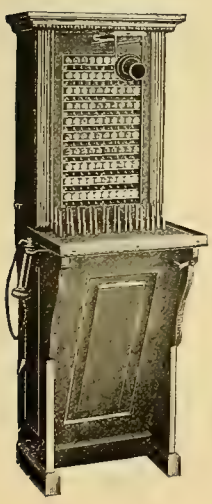

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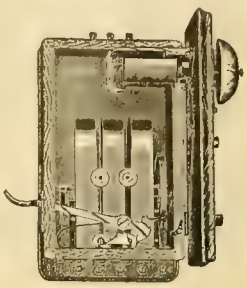

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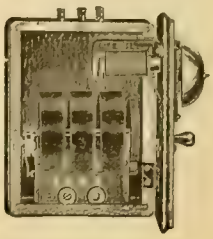

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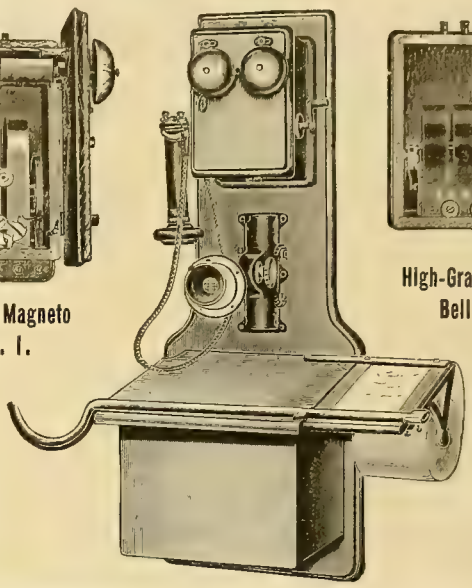

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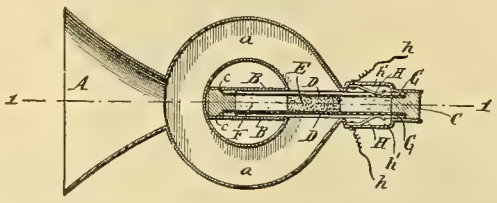

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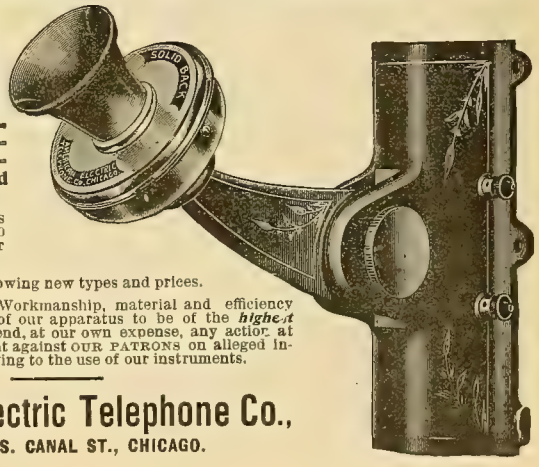

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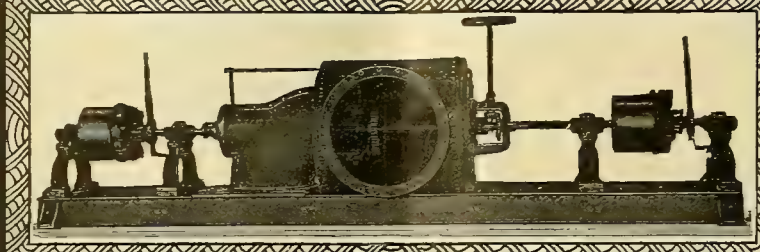

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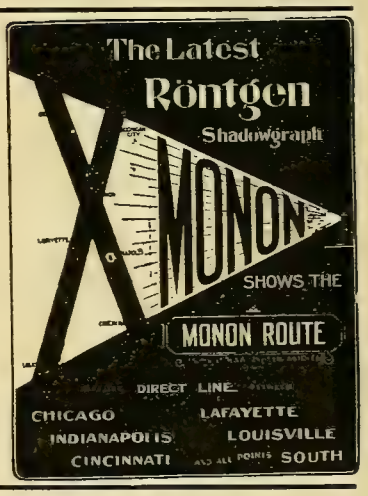

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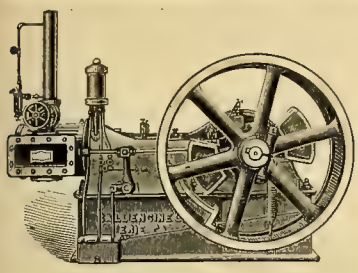

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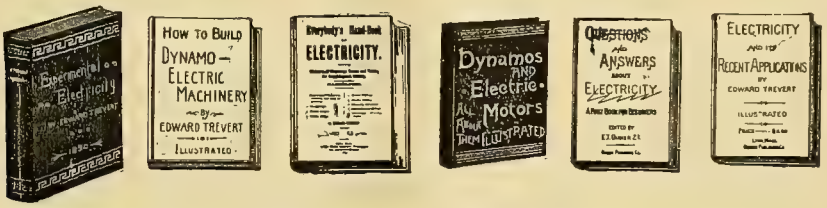

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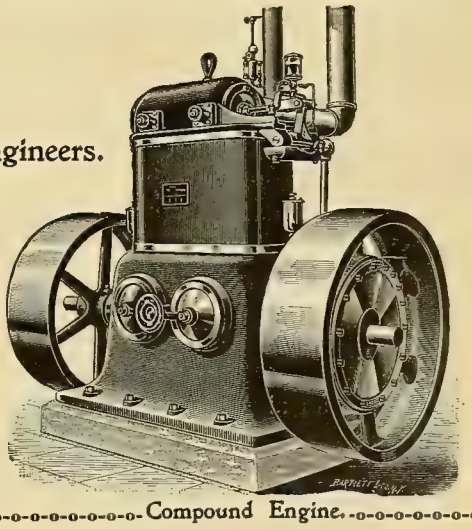

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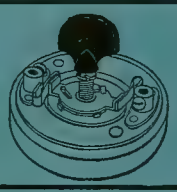

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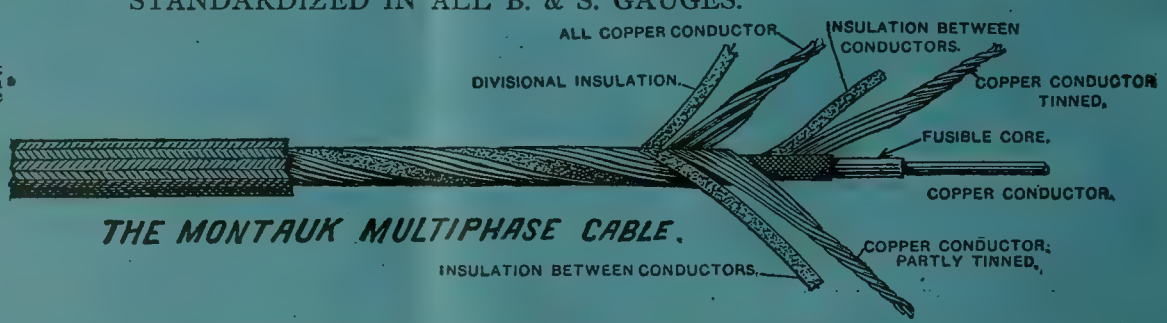

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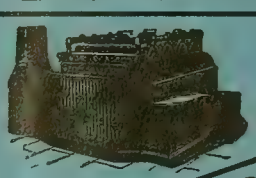
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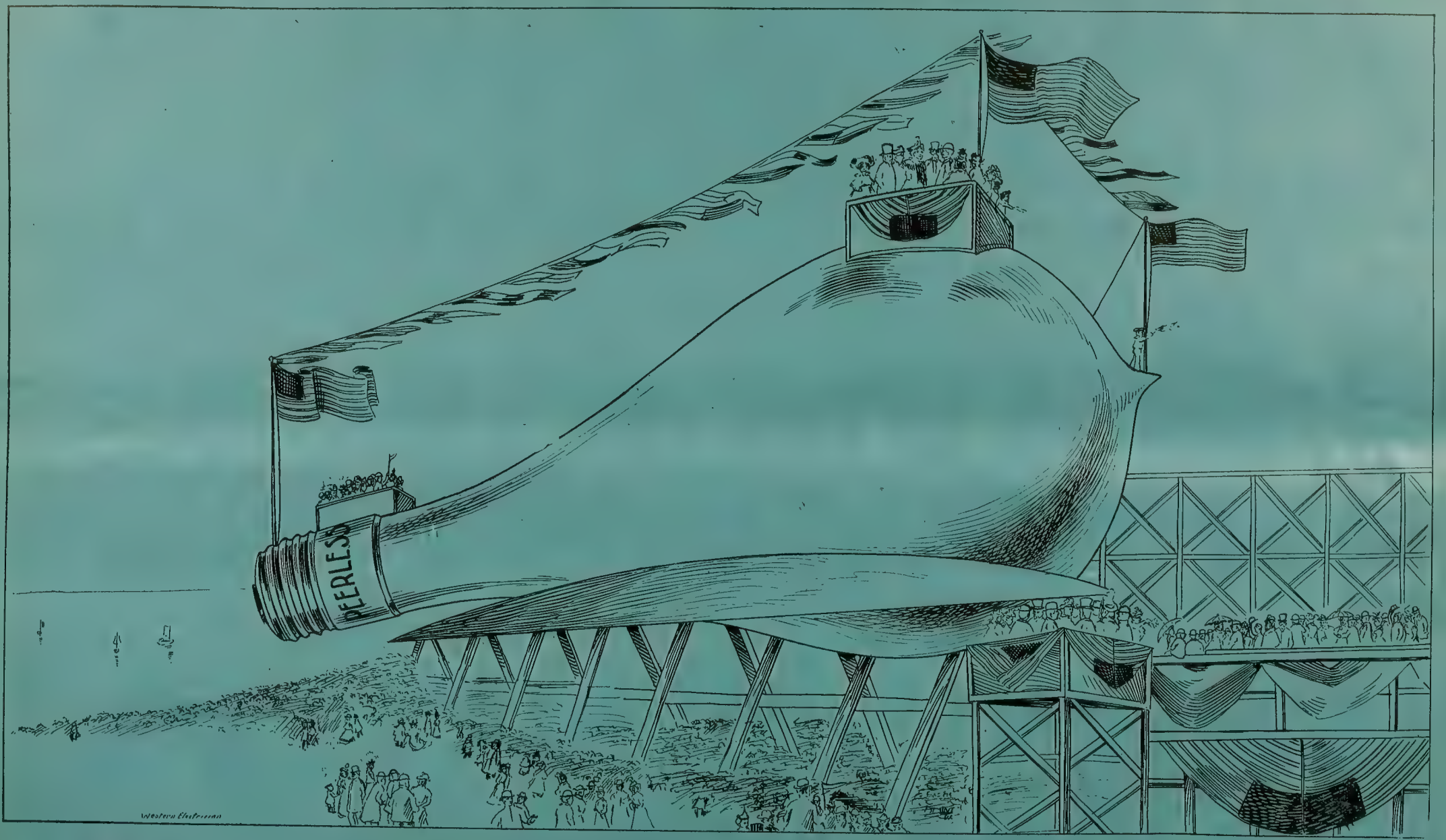

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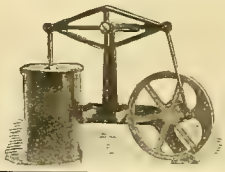
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PHILADELPHIA.
Switchboard Instruments
For Central Stations and Isolated Plants.
New York, 15 Cortlandt Street.
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The G. P. & D. Transmitter Co.
MONTPELIER, VT.

When you want to enlarge your plant and need a larger building, write us. We can save you money.

When your belts slip and bearings heat, remember us. We can do you good.

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REPAIR SHOPS

In the West. ELECTRICAL REPAIRS AND MACHINE WORK OF EVERY DESCRIPTION. In having your repair work done by a company operating hundreds of dynamos and motors you are sure of good work and get the benefit of our experience.

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ON 200 TO 600 V. A
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ANY ALTERNATIONS.

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Everybody Knows Stewart.

Write us for prices on anything in the following list or any other machinery wanted. This list comprises a few of our large stock.

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Two Edison No. 20, 60 k. w.
Four Edison No. 32, 100 k. w.
Two T.-H. m-p., 75 k. w.

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One 100 light, 16 c. p., 110 volt.
Two 2,000 c. p. T.-H. L. D. 2, 35 light.
One 2,000 c. p. Standard, 40 lt.
One 3,000 c. p. Brush, 1 lt.
One 10 ampere Wood, 3 lt.

Motors, 500 volt.
One ½ h. p. Keystone.
One 1 h. p. T.-H.
Two 7½ h. p. T.-H.
One 10 h. p. Eddy.
One 25 h. p. Brush.
One 50 h. p. T.-H.

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One 5 h. p. Varwick.
One 7½ h. p. Mather.
One 10 h. p. Daft.
One 15 h. p. Eddy.
One 16 h. p. Edison.

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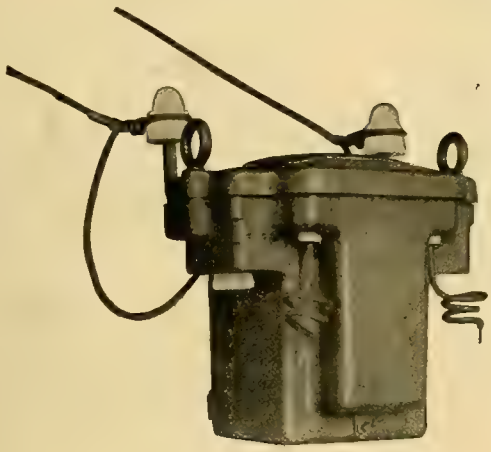

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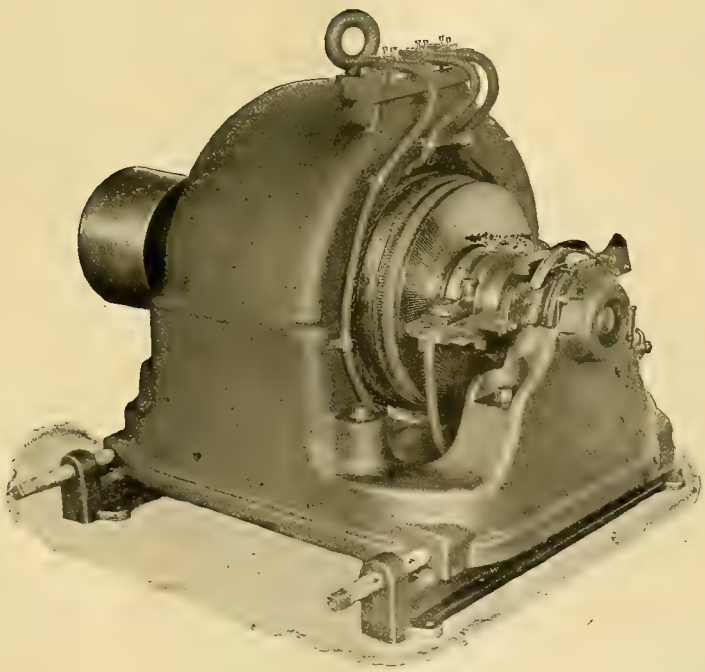

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CHARLES E. BROWN, Secretary.
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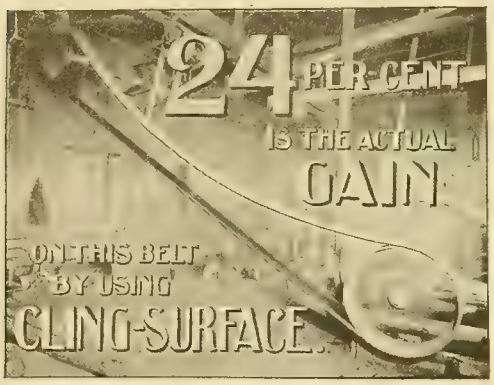

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Oily Dynamo Belts with

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Will Stop all Slipping, Relieve the Bearings,

And Increase the Power, in some cases as much as thirty per cent, and keep the belts soft and pliable.

CLING-SURFACE MFG. CO., 177-182 VIRGINIA STREET, BUFFALO, N. Y.

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National India Rubber Co.
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Roebling's Sons Co., J. A.
Simplex Electrical Co.
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United Elec. Imp. Co.
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Akron Elec. Mfg. Co.
Beck, A., Electric Co.
Bullock Elec. Mfg. Co.
Chicago Rheostat Co.
Commercial El. Supply Co.
Diehl Mfg. Co.
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American Pegamoid Co.
Central Electric Co.
Cling-Surface Mfg. Co.
Commercial El. Supply Co.
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Standard Brass Works.

Platinum.
Baker & Co.

Poles.
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Central Mfg. Co.
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Worcester & Co., C. H.

Porcelain.
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Commercial El. Supply Co.
Empire China Works.
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Refiners.
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Reflectors.
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Re-Winding—Repairs.
Beck, A., Electric Co.
Cass & Aaron Co.
Chicago Armature Co.
Chicago Edison Co.
Cleveland El. Trading Co.
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Chicago Rheostat Co.
Cutler-Hammer Mfg. Co.
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Farr Tel. & Cons. Sup. Co.
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Rawson Electric Co.
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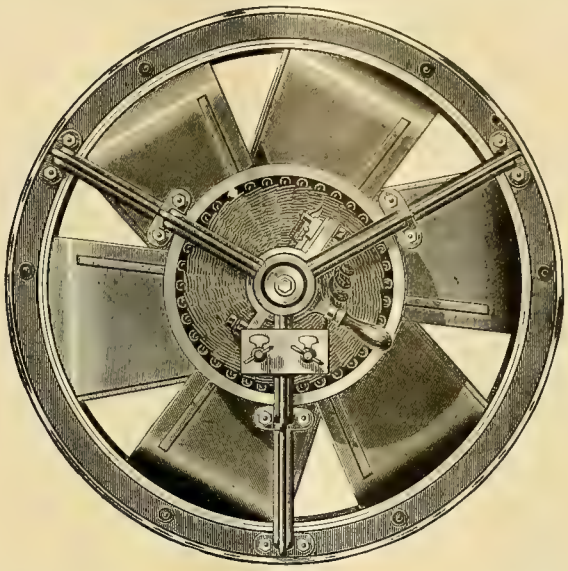

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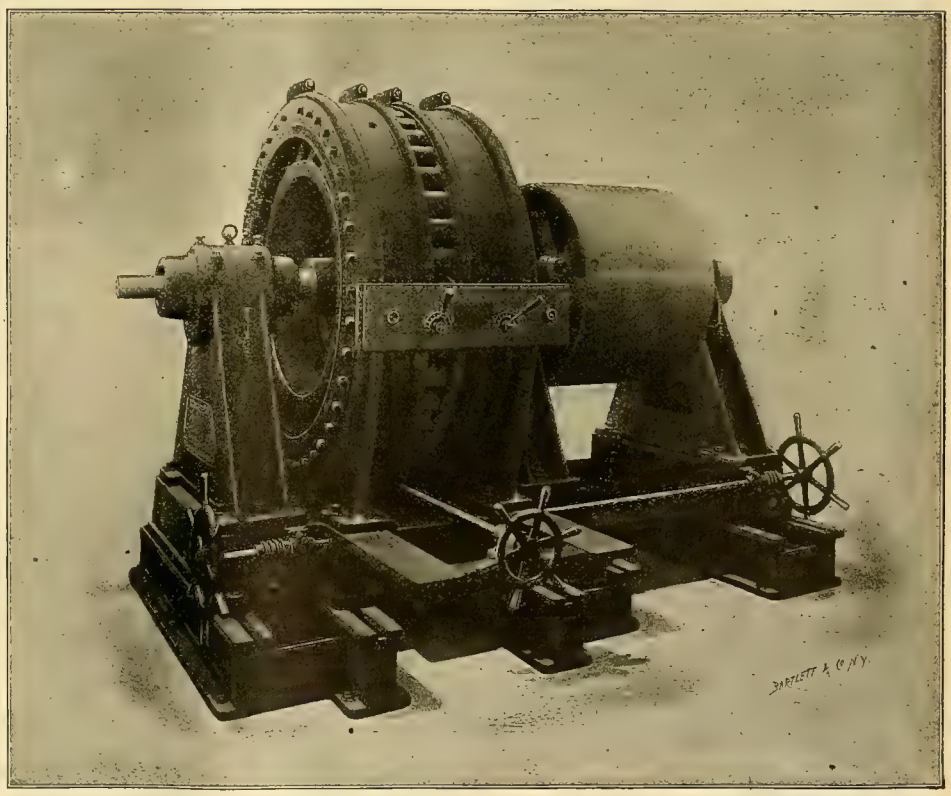

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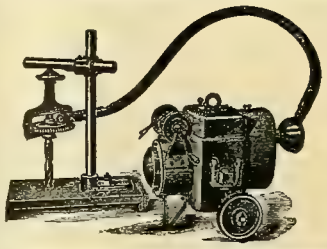

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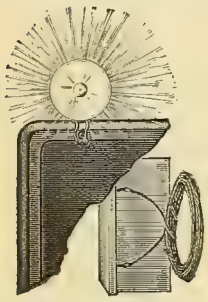

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Battery Table Lamp, $2.75 complete.

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$1.00 Motor.

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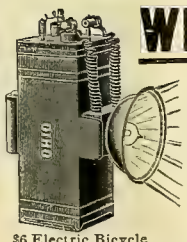

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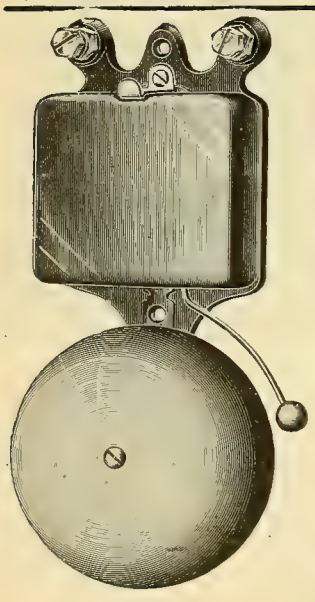

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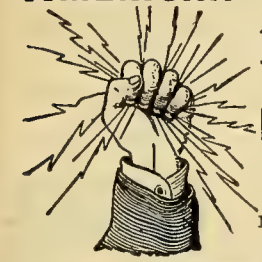

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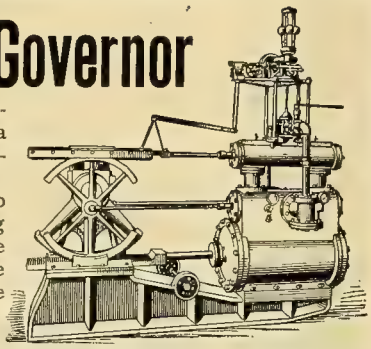

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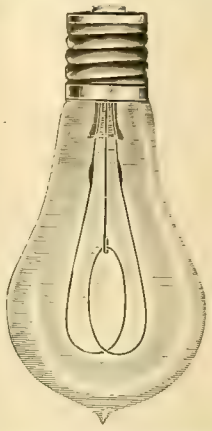

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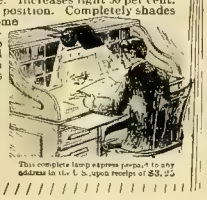

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Small Springs of Every Description, Flat or Round Wire, Steel or Brass, Cold Rolled Steel .003 to .062, kept in stock. Springs enameled or plated. Send sample for quotation.
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By an experienced man, position as superintendent or engineer of small plant. Can furnish first-class references. Address C. E. E., care of Western Electrician, 510 Marquette Building, Chicago.

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A man competent to do line work, trim lamps and assist engineer in the operation of an electric light plant. Wages thirty-five dollars per month. Apply to

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For any additional information apply to this office or R. S. Graham, Superintendent, Mt. Pleasant, Mich. W. A. JONES, Commissioner.

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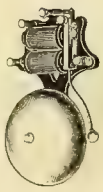

Straight Line

Pivoted Armature,
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Changeable Platinum Contacts,
Binding Posts,
Magnets or Gong

Cannot turn or loosen, and every part has an improvement.

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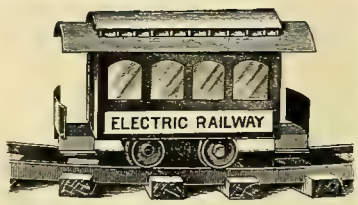

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Fan Motors, etc.
Write for Catalogue "B."

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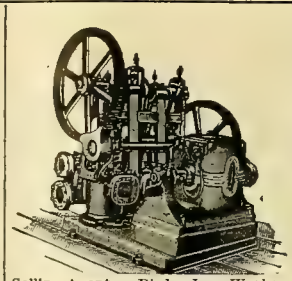

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SINGLE AND DOUBLE ACTING.

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Pumping Machinery for Every Possible Duty. New Catalogue Free.
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Automatic Motor Starters. Overload Motor Starters.
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WILL MAKE YOUR COMMUTATORS SHINE.

BETTER THAN ANY SO-CALLED "COMPOUND"

WILL NOT GUM THE BRUSHES.
CONTAINS NO OIL, GREASE OR ACID.
Satisfaction Guaranteed.

PRICES:
One Dozen, $5.00
One-half Doz., 2.75
Single Stick, .60
Send for Trial Stick.

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ALSO MANUFACTURERS OF PERFECTION BRUSHES AND IMPERIAL RHEOSTATS.

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Best prices paid for scrap copper wire, and commutator segments.
Red brass wanted.

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A 45 K. W. Edison, 125 volts, late type, almost a new machine, self-oiling	510 00

And a lot more.

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We Buy, Sell or Exchange all kinds of Electrical Machinery.

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One 500 light Rockford, self-oiling bearings	260.00
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One 275 light T.-H.	250.00
One 250 light Motor Type	250.00
One 350 light U. S.	225.00
One 135 light Bain, self-oiling bearings	135.00
One 100 light U. Elec. Imp. Co. (new)	125.00
One 100 light Detroit Electric Works	125.00
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One 150 light Colbourn, (new)	80.00
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One 150 light Detroit slow speed 450 R. P. M.	200.00

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Three h. p. Chicago	$ 50.00
One 10 h. p. Brownell Motor, self-oiling bearings	100.00
One 10 h. p. 220 volt Brownell Motor	100.00
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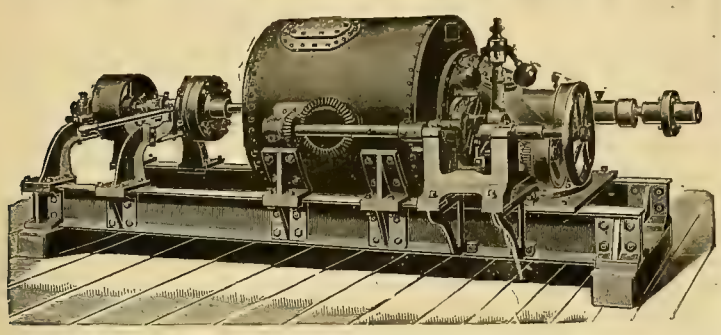

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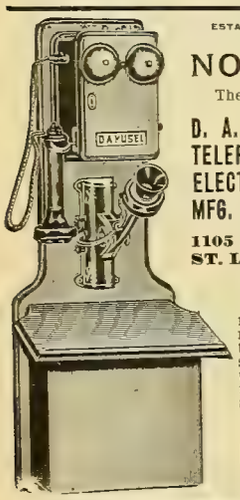

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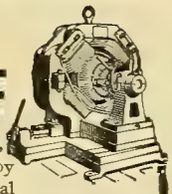

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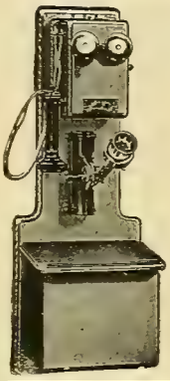

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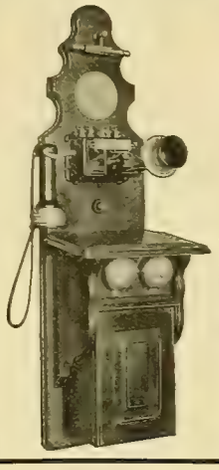

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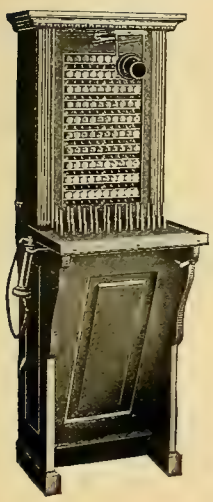

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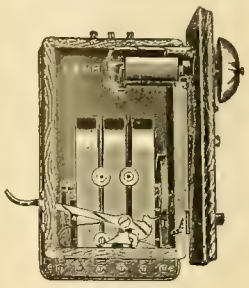

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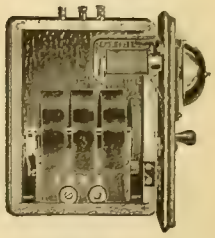

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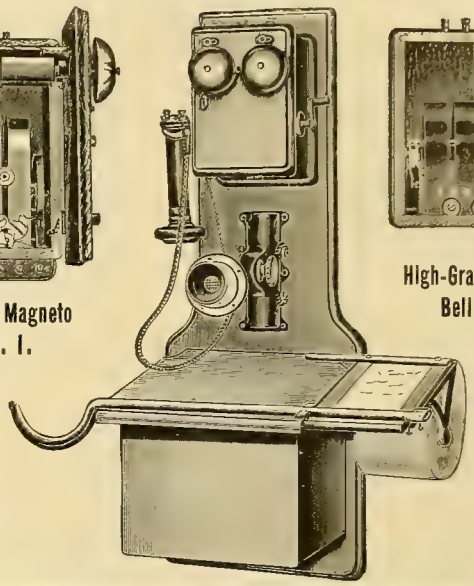

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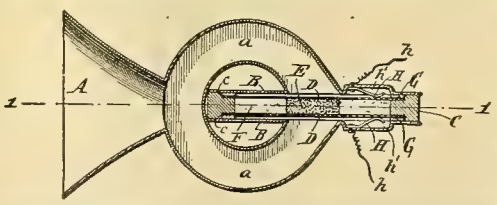

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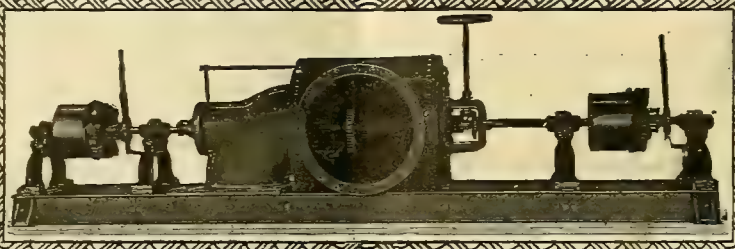

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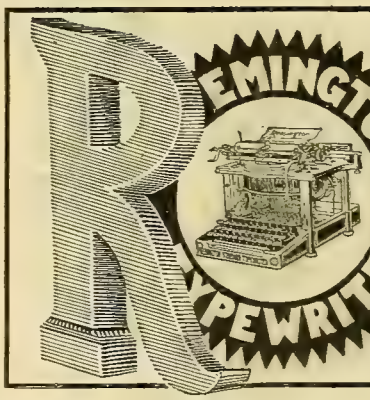

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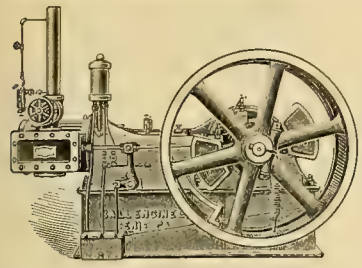

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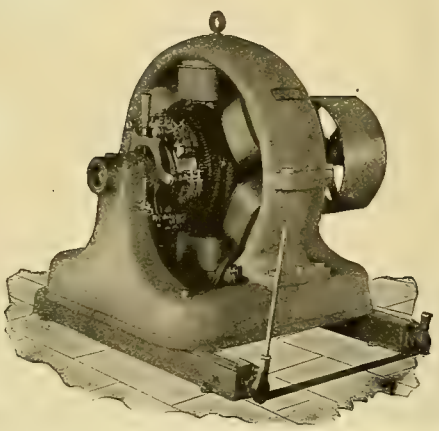

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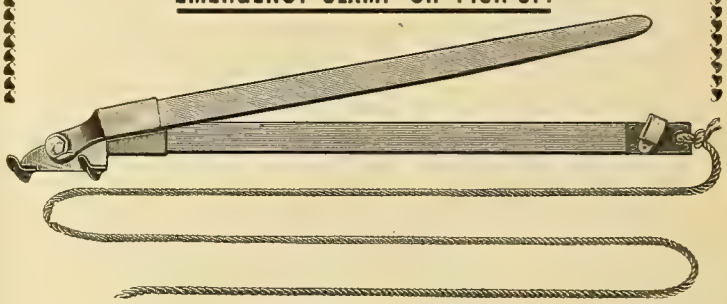

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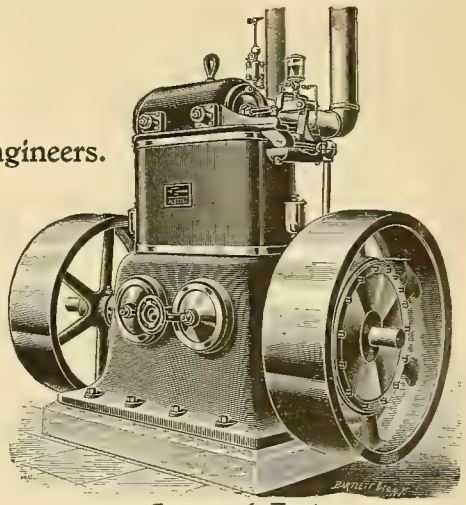

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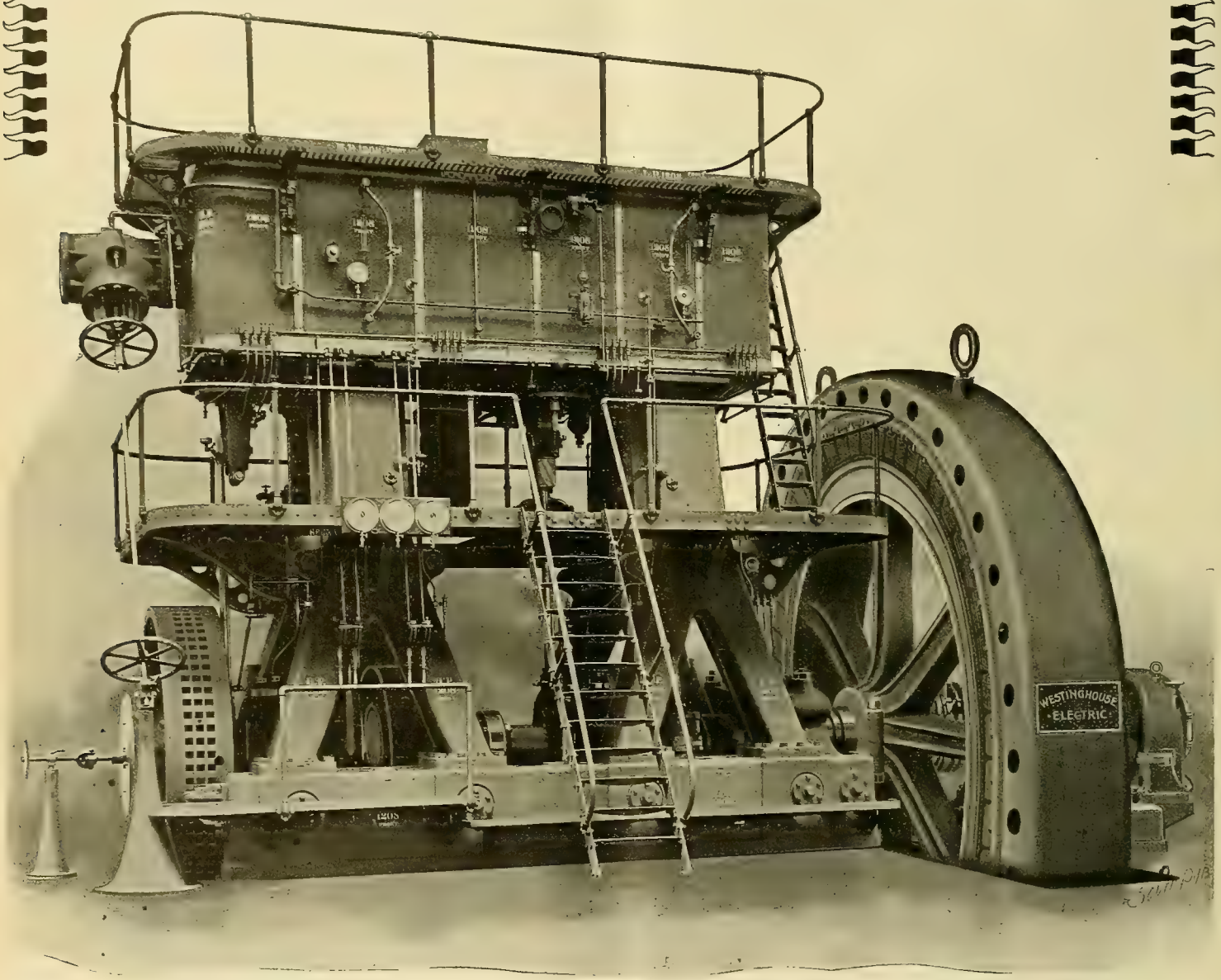

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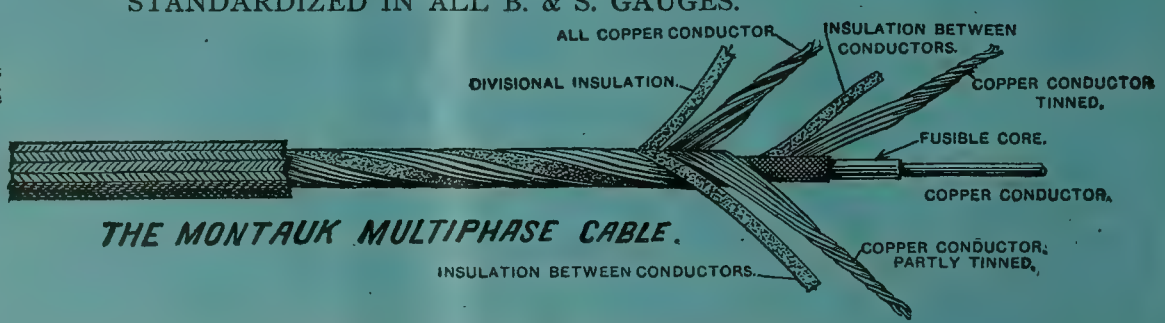

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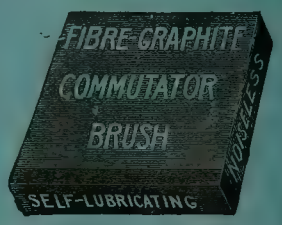

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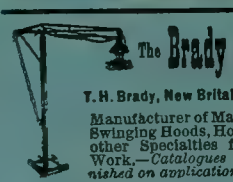
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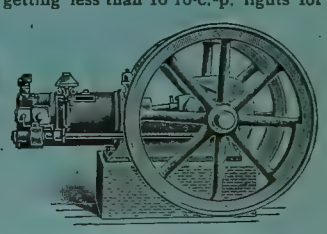

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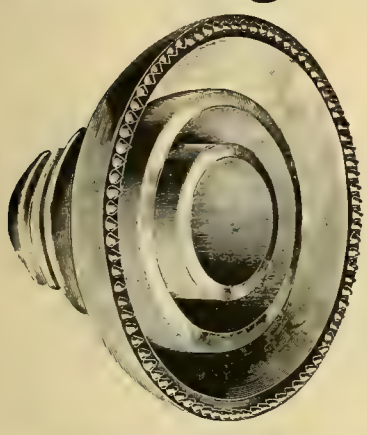

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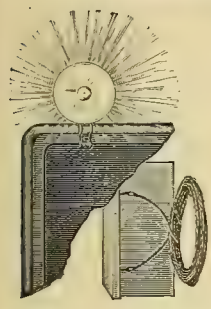

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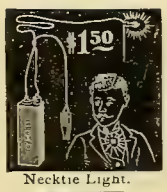

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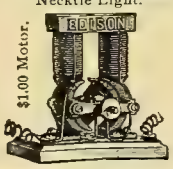

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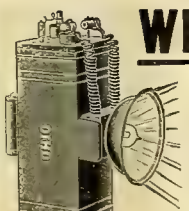

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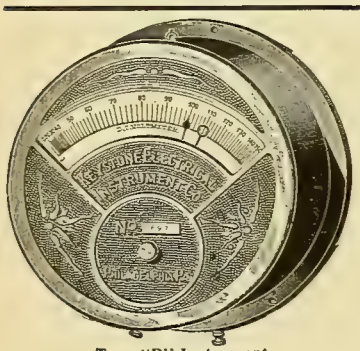

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Switchboard Voltmeters, Ammeters, Ground Detectors and Differential Voltmeters.

We meet all the requirements of modern Central Stations or Isolated Plants, whether using direct or alternating current circuits.

Our instruments are constant and durable, sensitive and accurate, pleasing in appearance and always correct.

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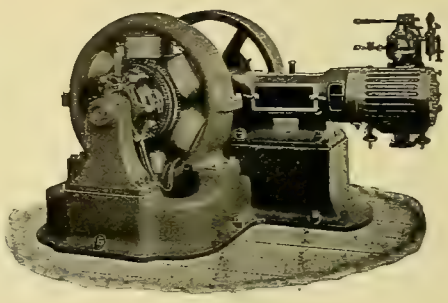

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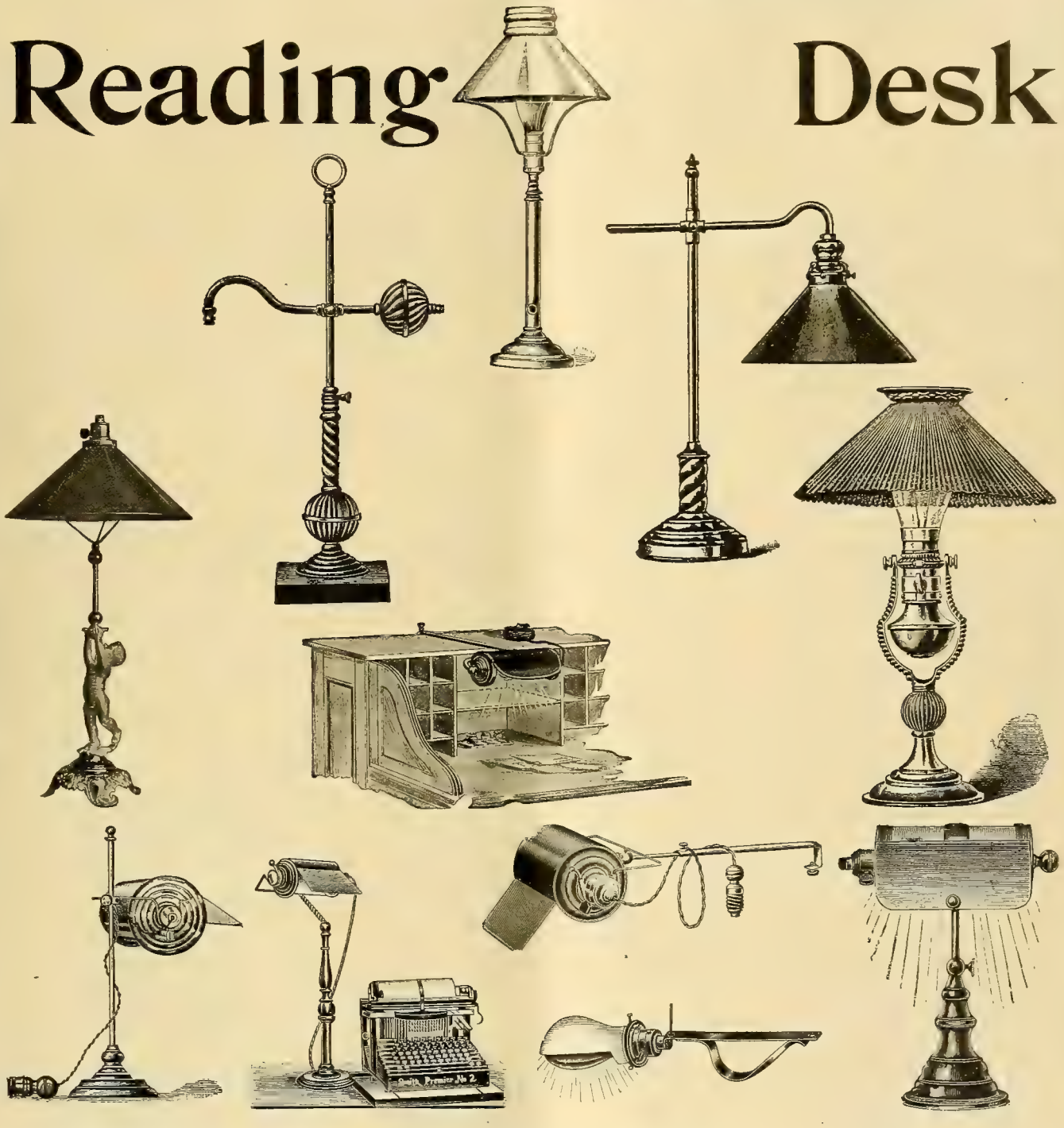

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Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

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For Enclosed Arcs.

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For the Independent Control of the Voltage of Circuits, involving the introduction of NO RESISTANCE

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PITTSFIELD, MASS.

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Are Now Well Established.

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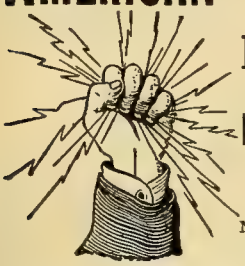

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Railway Feeder and Trolley Wire,
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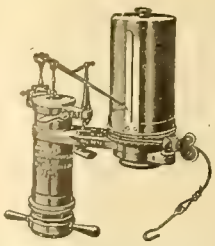
CHICAGO STORE, F. E. Donohoe, 241 Madison St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.



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FOR SWITCHBOARD. RAILWAY and MOTOR USE.

All sizes of Stranded and Flexible Wire and Cables with Clark's Insulation

Inspector Boston Fire Underwriters' Union says:
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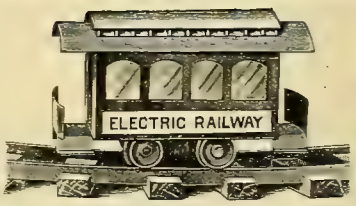

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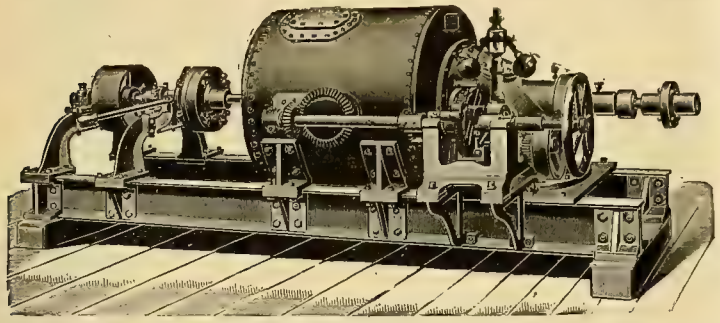

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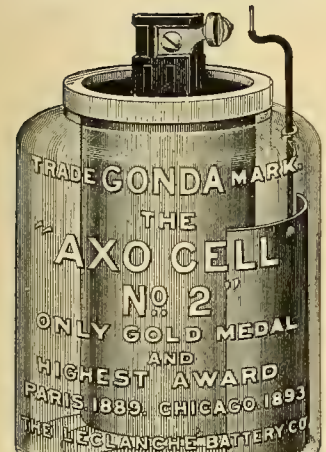

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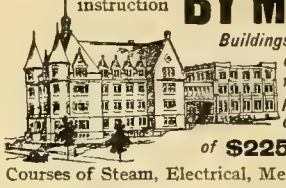

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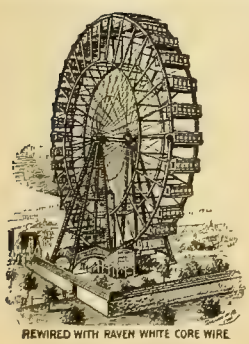

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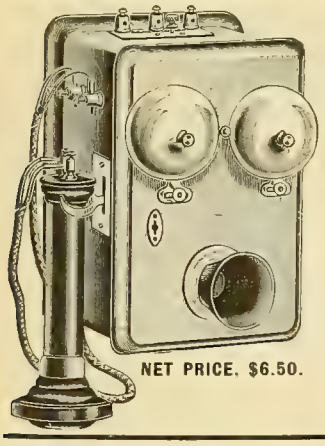

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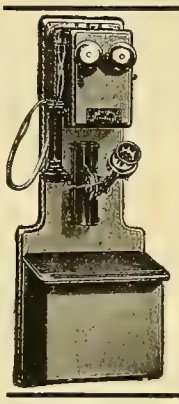

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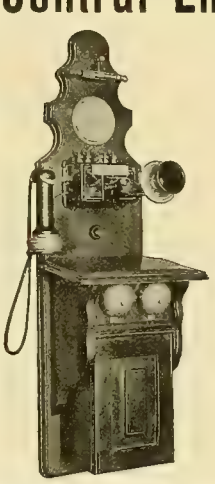

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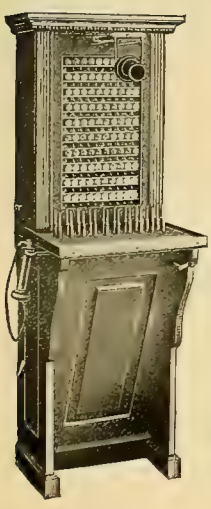

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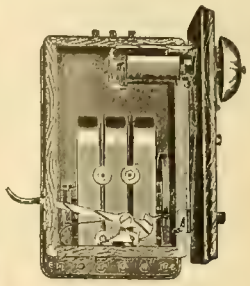

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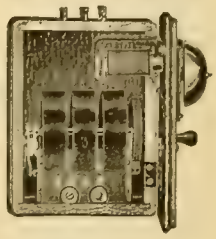

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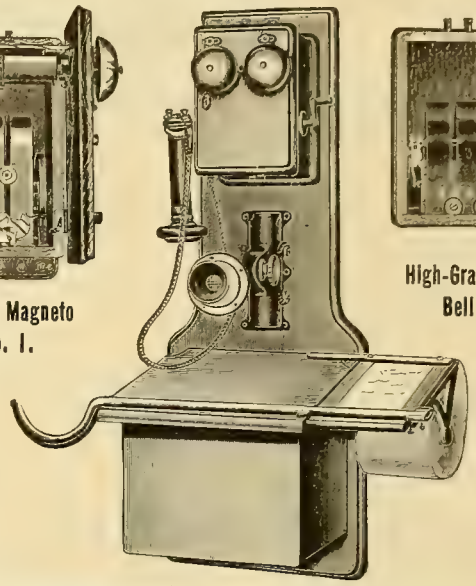

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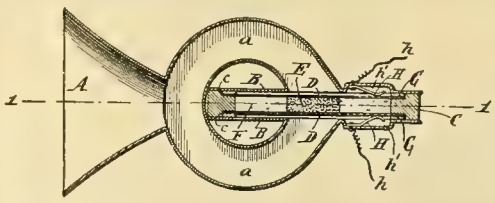

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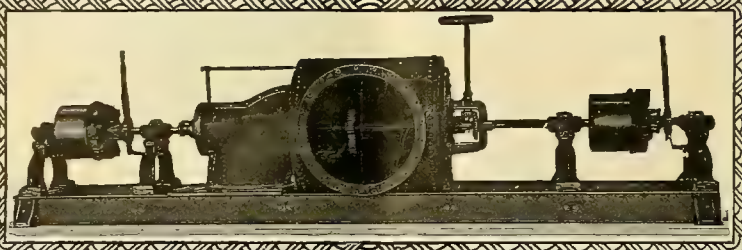

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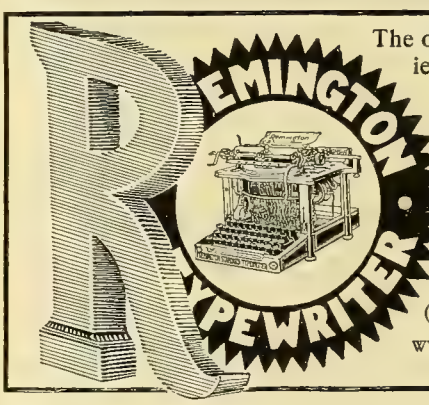

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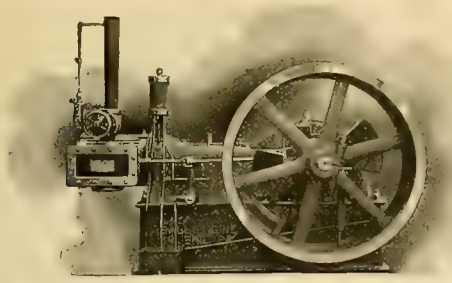

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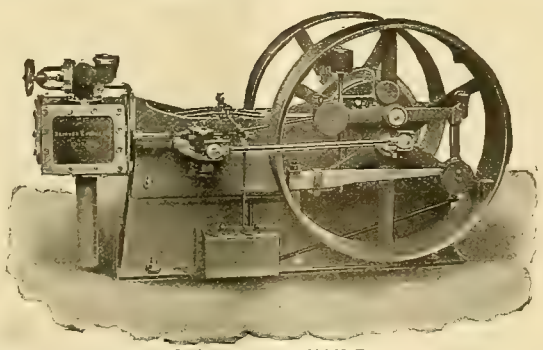

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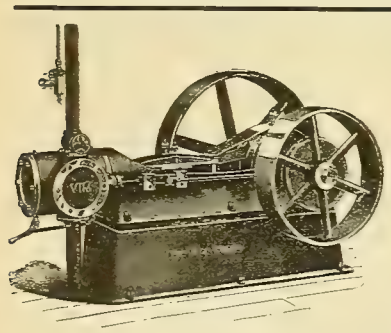

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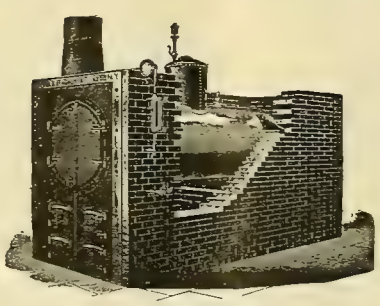

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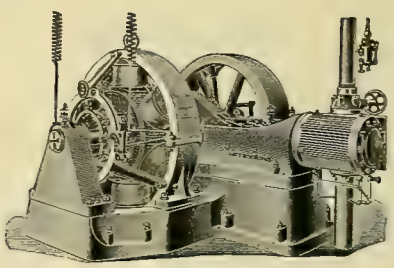

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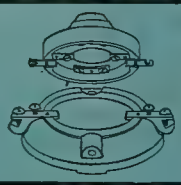

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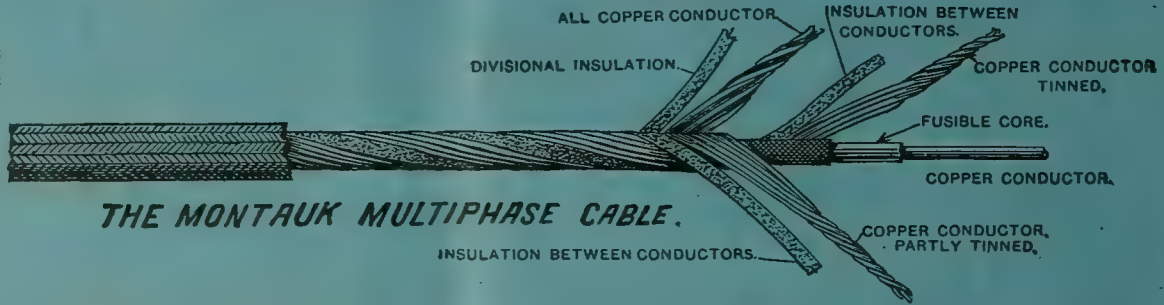

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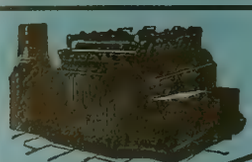

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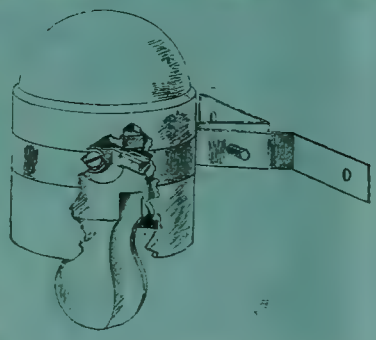

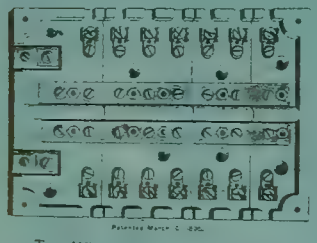

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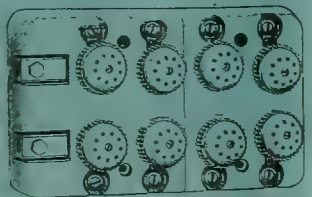

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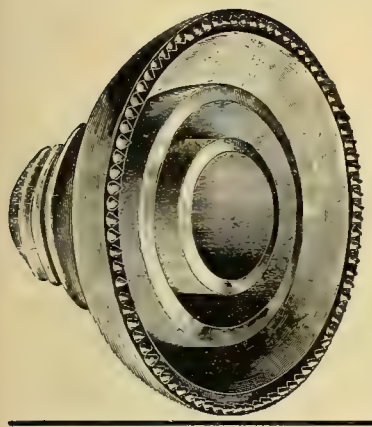

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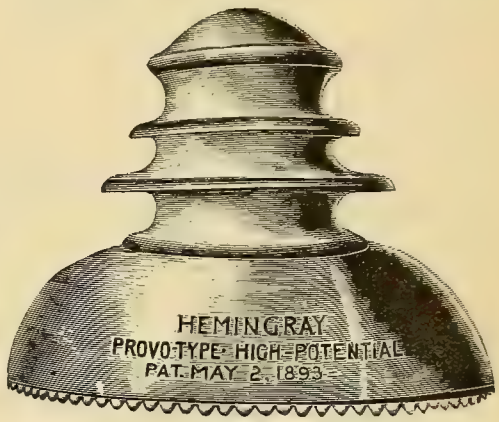

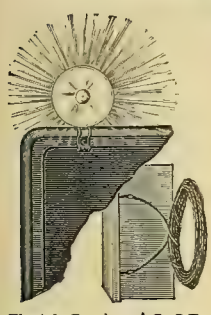

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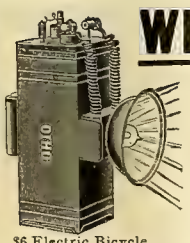

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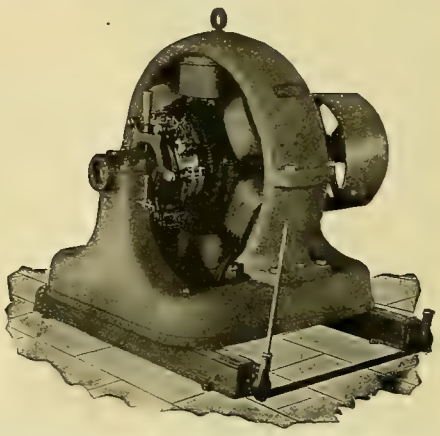

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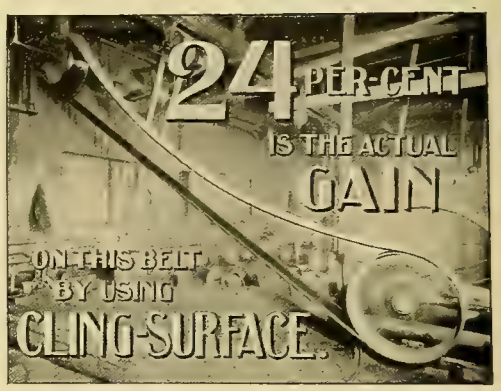

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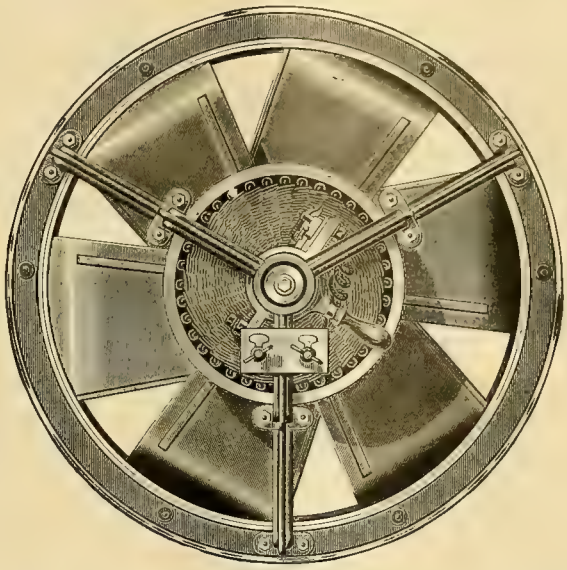

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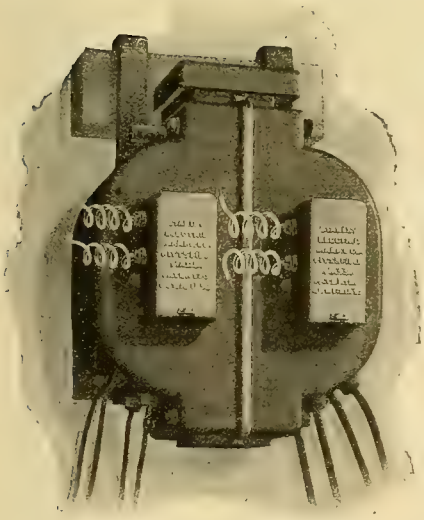

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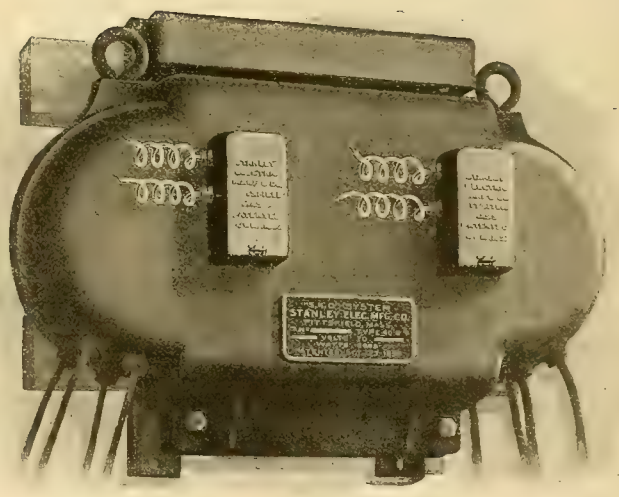

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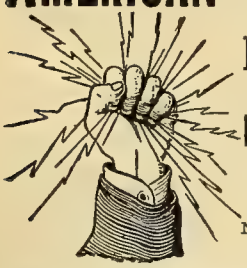

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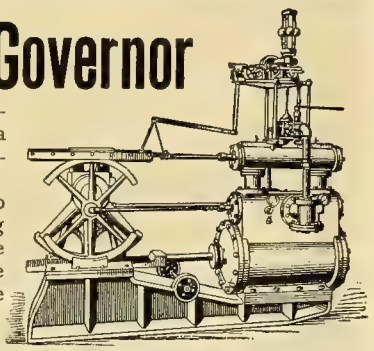

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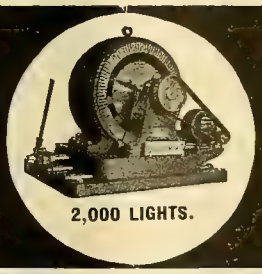

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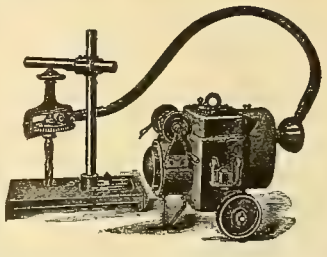

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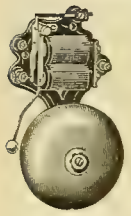

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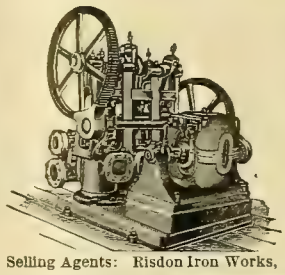

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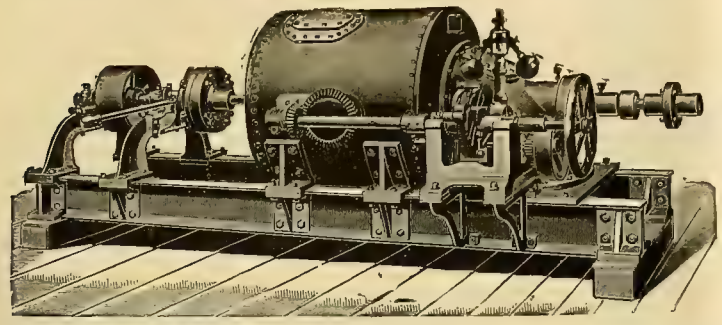

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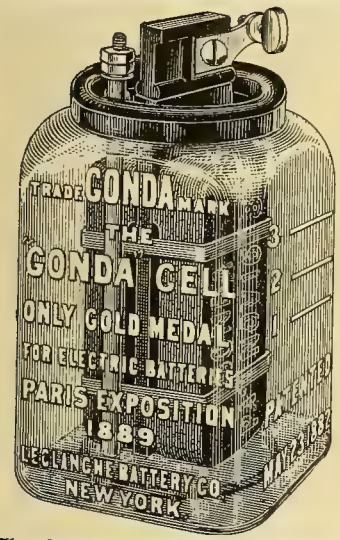

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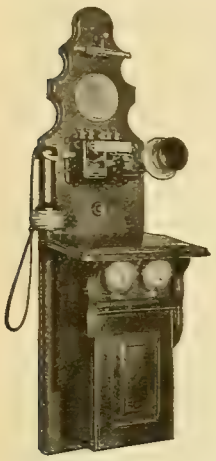

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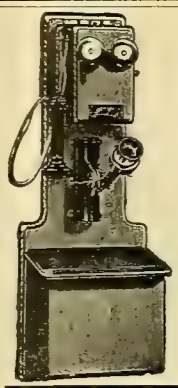

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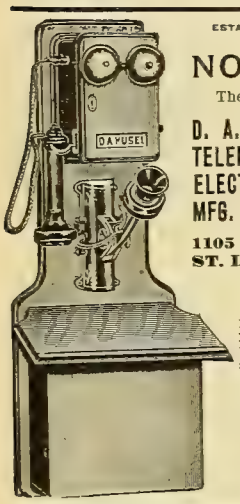

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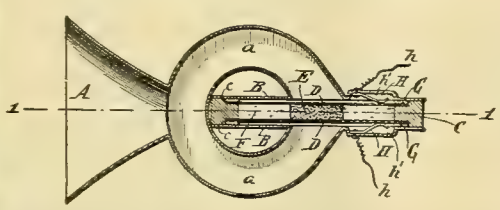

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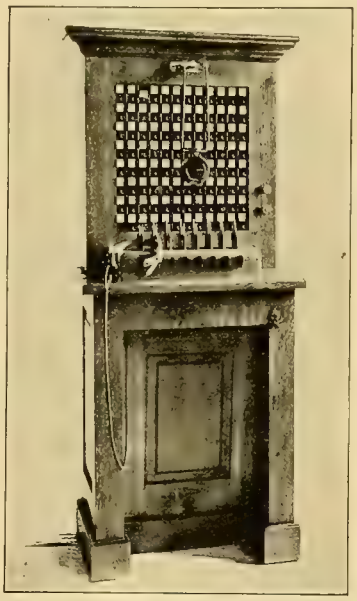

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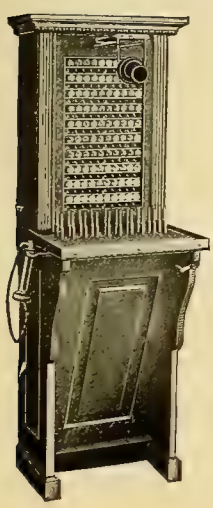

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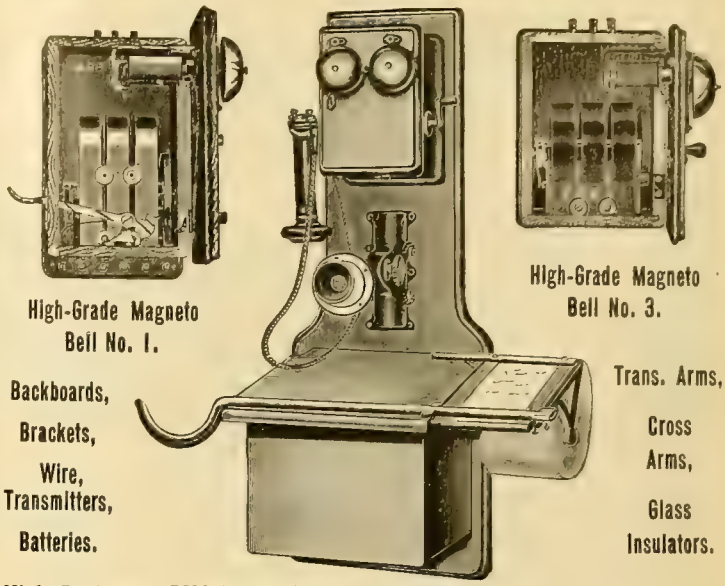

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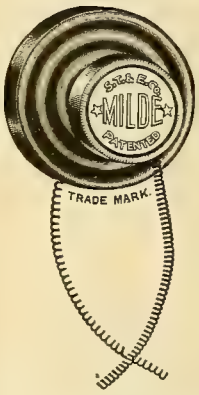

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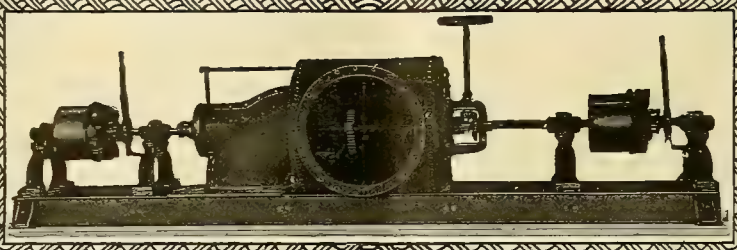

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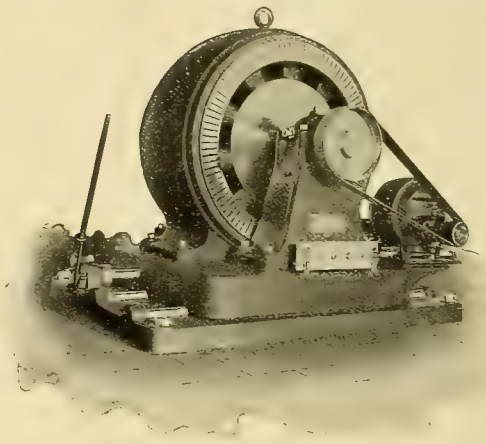

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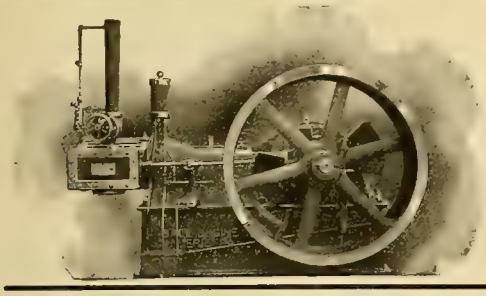

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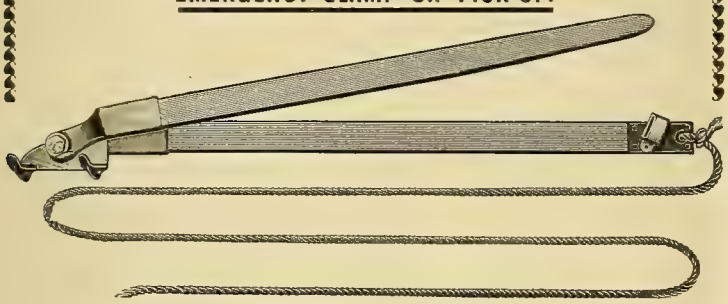

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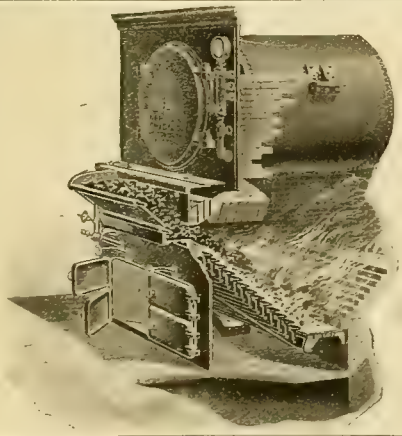

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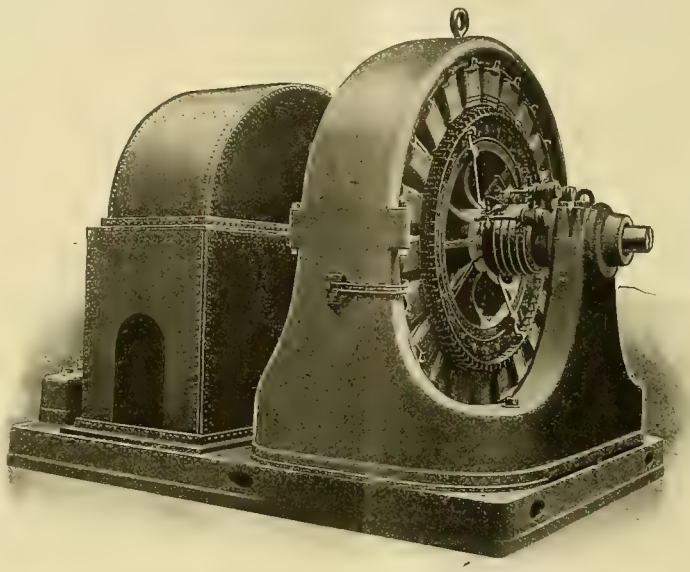

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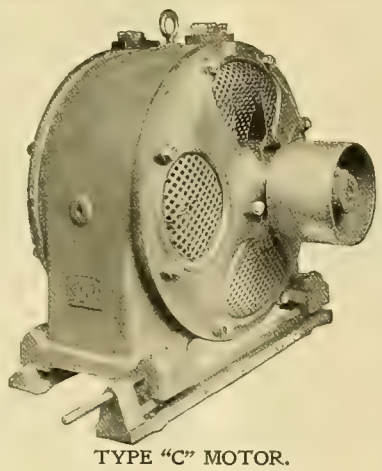

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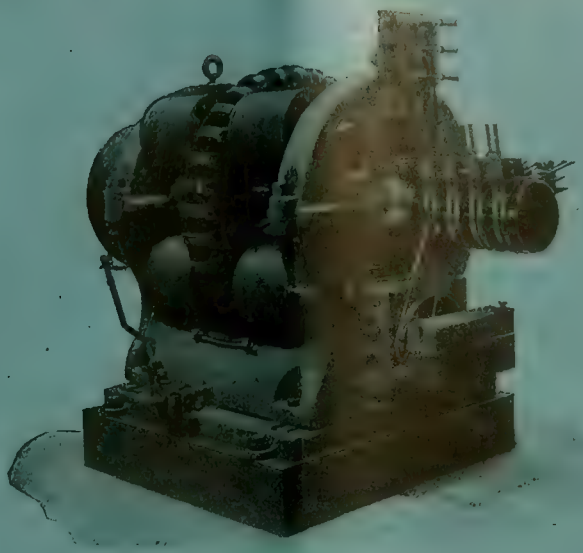

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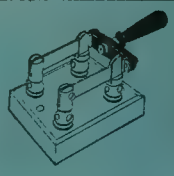

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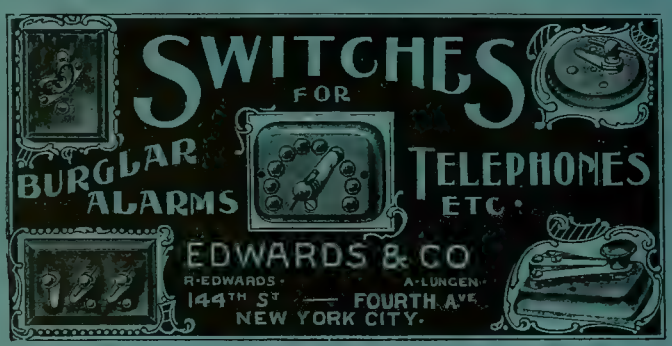

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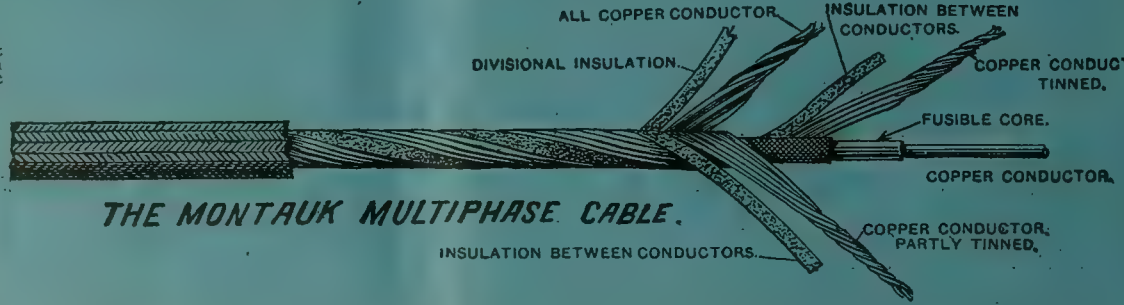

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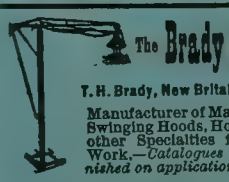
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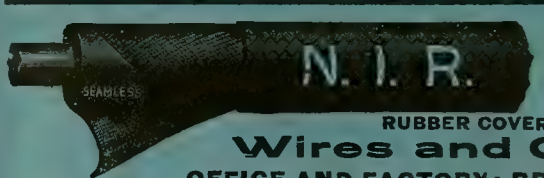

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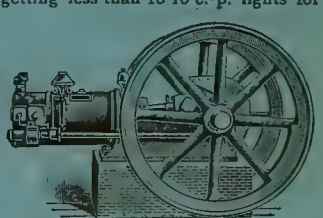

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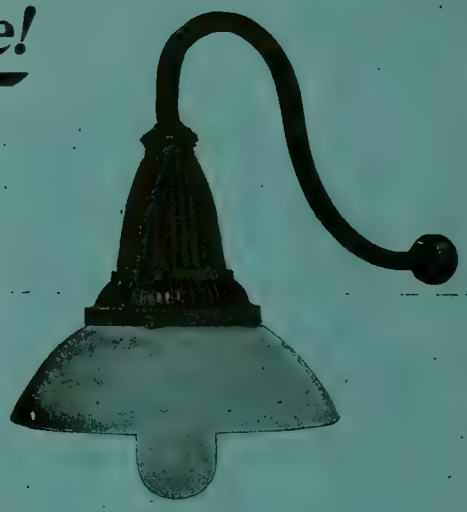

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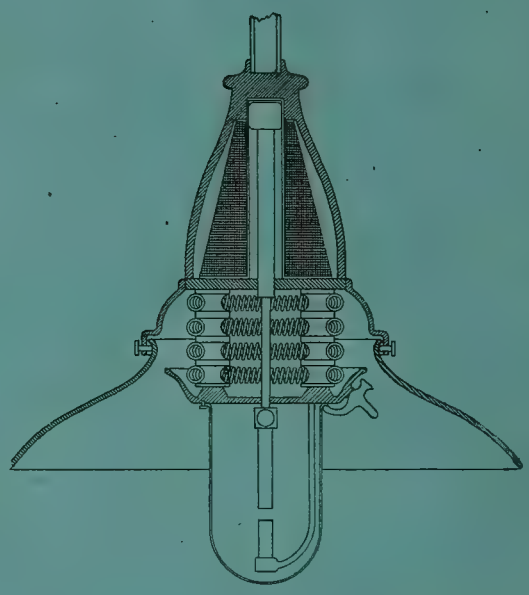

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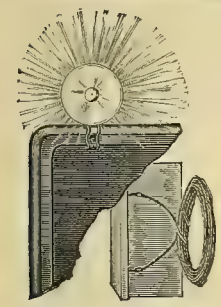

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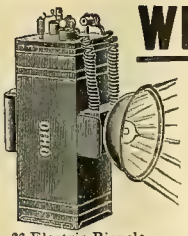

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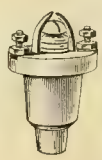

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HARDTMUTH CORED AND SOLID CARBONS

FOR DIRECT CURRENT ARC LAMPS.

WE HAVE IN STOCK THE FOLLOWING SIZES:

CORED CARBONS.

Diameter. Length.
5-16 in. x 6 in., 6½ in., 7 in., 7½ in. and 8 in.
3-8 in. x 7 in., 8 in., 9 in., 9½ in., 10 in. and 12 in.
7-16 in. x 6 in., 7 in., 8 in., 9 in., 9½ in., 10 in. and 12 in.
1-2 in. x 6 in., 7 in., 7½ in. and 8 in.
5-8 in. x 12 in.

SOLID CARBONS.

Diameter. Length.
7-16 in. x 7 in. and 10 in.
1-2 in. x 6 in., 7½ in. and 12 in.

Having received a large consignment of these Carbons just before the new tariff went into effect, we are prepared to make very low prices. Send for price list.

CHICAGO EDISON COMPANY,

EDISON BUILDING, 139 ADAMS STREET, CHICAGO.

WE SELL

CREFELD ELECTRICAL WORKS

WEATHERPROOF
ANNUNCIATOR
OFFICE
MAGNET
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We carry a large stock and can fill your orders promptly.

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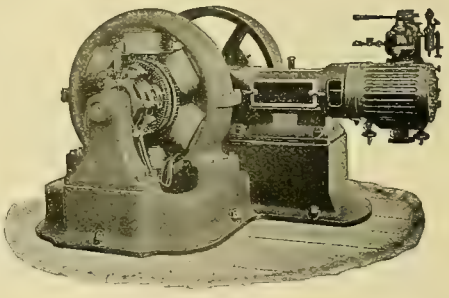
Motors,
Direct-Connected,
Slow Speed,
Moderate Speed,
Mining Locomotives.



All of the highest efficiency, most modern construction and most graceful design.

WRITE FOR CIRCULARS AND READ OUR GUARANTEE.

PEOPLES' ELECTRIC MFG. CO.,

ELECTRICAL ENGINEERS AND CONTRACTORS,

——And Manufacturers of——

Open and Enclosed Arc Lamps

FOR SERIES, ALTERNATING AND DIRECT CURRENT.

Dynamos and Motors. Switchboards. Panelboards.

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A MODERN CATALOGUE

A MODERN DISTRIBUTION.

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CLING-SURFACE MFG. CO., 177-182 VIRGINIA STREET, BUFFALO, N. Y.

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Cass & Aaron Co.
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Western Elect. Supply Co.

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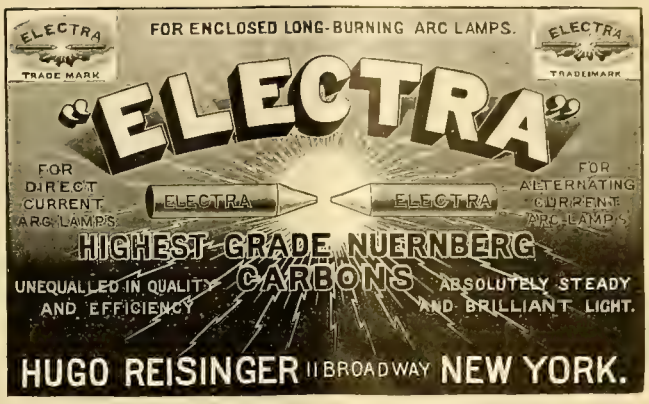
Edison Lamp Dept.
Queen & Co.

For Alphabetical Index of Advertisements See Page III.

The "ELECTRA" Highest Grade Nuernberg Carbons are recognized as standard all the world over.

All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade mark "ELECTRA."



Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

COLUMBIA CARBONS

For Enclosed Arcs.

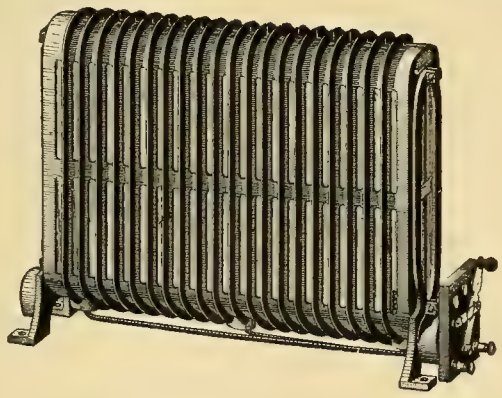
As COLUMBIA is the gem of the ocean, so is the "COLUMBIA" the gem of Enclosed Arc Carbons.

MANUFACTURED BY

THE NATIONAL CARBON CO.

600 HIGHLAND AVENUE, - - - - CLEVELAND, OHIO.

THE W. E. ELECTRIC HEATER.



The ELECTRIC HEATER is extremely valuable in heating small offices, bath-rooms, cold corners, street railway waiting-rooms, and the Summer villa. The heater is perfectly clean, does not vitiate the air, and is portable. It is finished in black enamel and Japan.

SEND FOR SPECIAL BULLETIN 9 E H.

WESTERN ELECTRIC COMPANY,

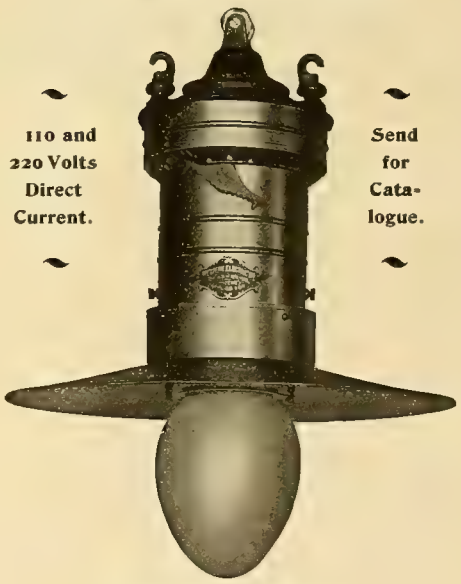
CHICAGO. NEW YORK.

LONDON, 79 Coleman Street. ANTWERP, 33 Rue Boudewyns PARIS, 45 Avenue de Breteuil.

Twenty inches long, Easily trimmed.

110 and 220 Volts Direct Current.

Send for Catalogue.



Enclosing Globe P, or Egg Globe.

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ELECTRICAL SUPPLIES AND APPARATUS.

**Arc and Incandescent Lighting Dynamos,
Power Dynamos and Motors,
Arc and Incandescent Lamps,
Switches, Sockets, Cut Outs,
Fan Motors, Telegraph, Testing and
Measuring Instruments, Wire, Bells,
Batteries and all Sundries Required in
an Electrical Installation.**

WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

LONDON, 79 Coleman St. ANTWERP, 33 Rue Boudewyns. PARIS, 45 Avenue de Breteuil.

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OF

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Are Now Well Established.

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TELEPHONE HAND-BOOK

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Deals with them. No matter what kind of Telephones and Switching Apparatus you use, or expect to use,

YOU WILL FIND IT USEFUL.

It is a Practical Book
for the Practical Man
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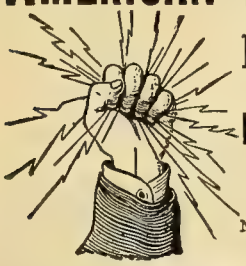
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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CHICAGO STORE, F. E. Donohoe, 241 Madison St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

A Man of Sense

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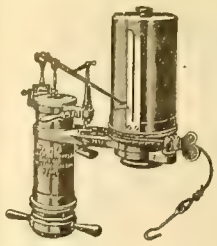

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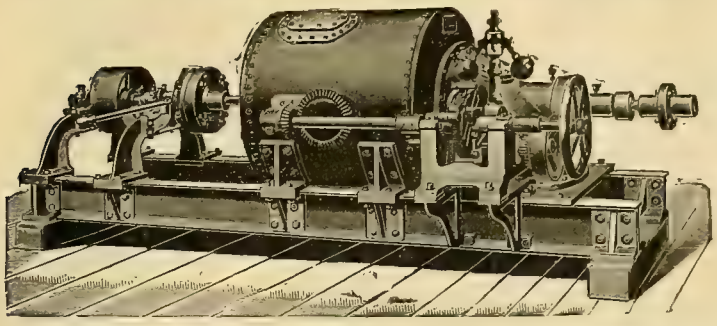

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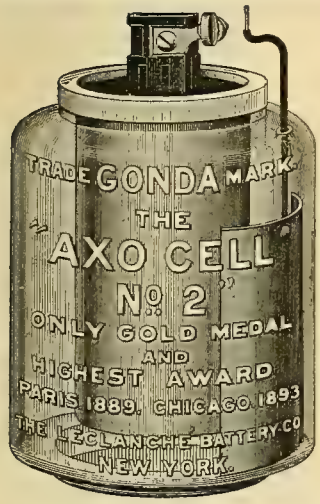

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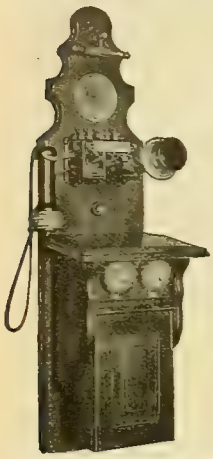

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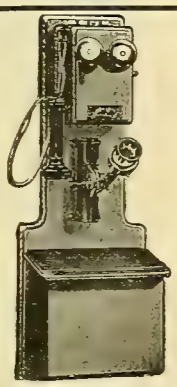

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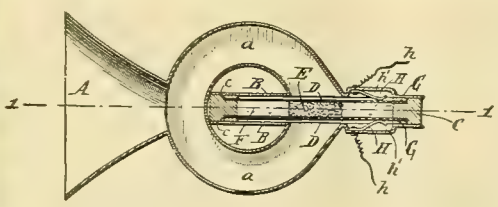

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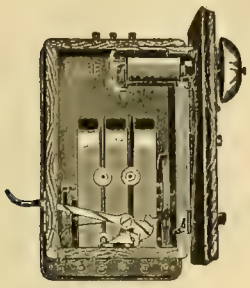

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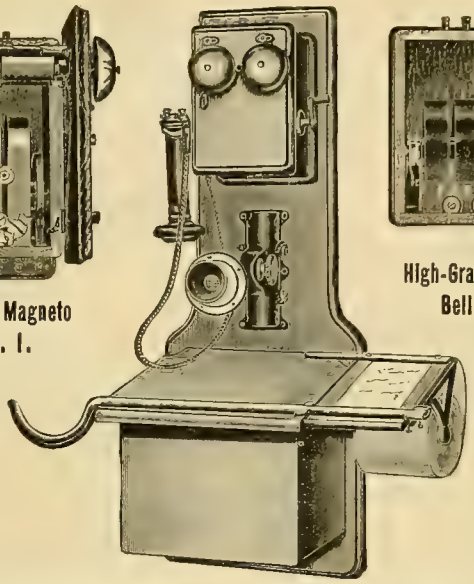

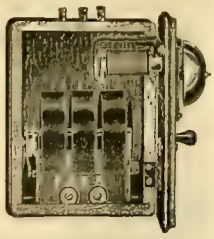

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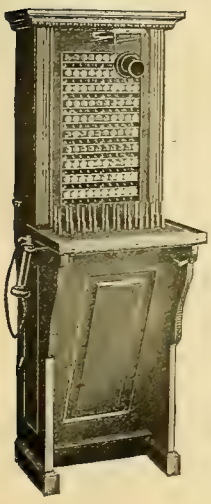

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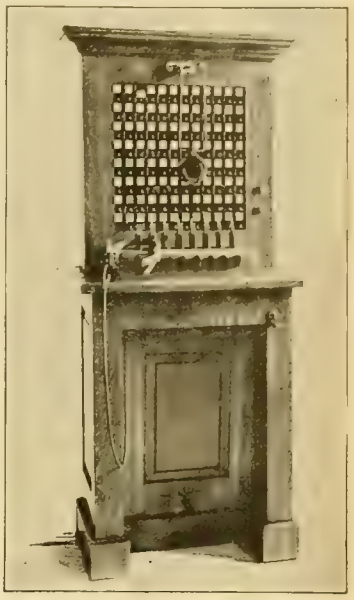

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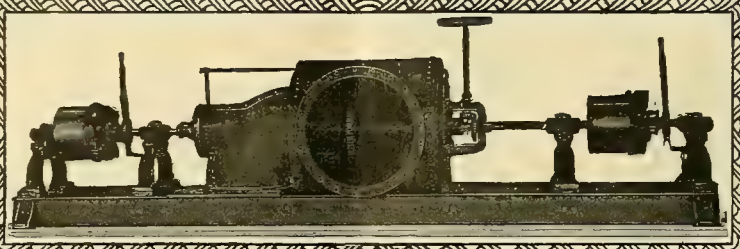

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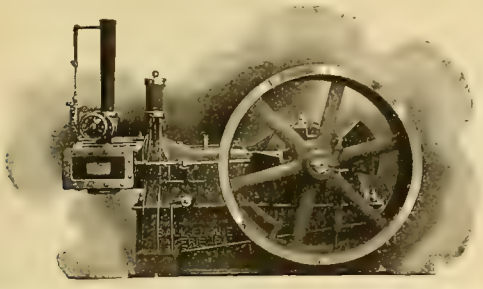

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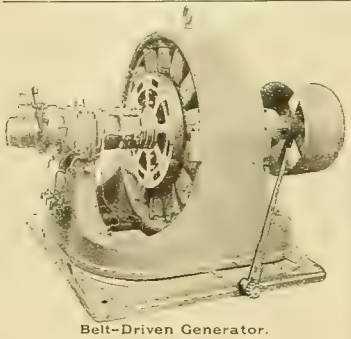

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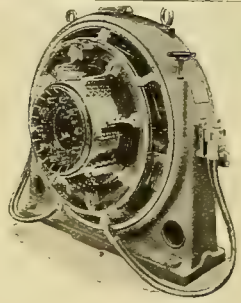

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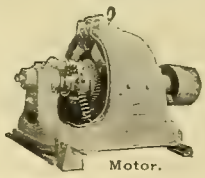

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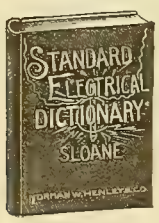

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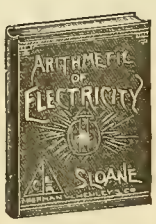

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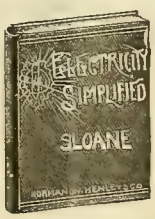

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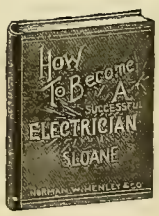

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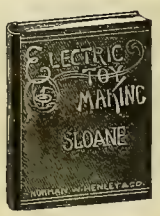

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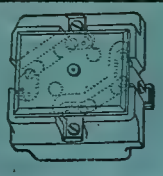

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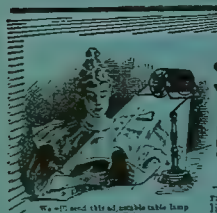

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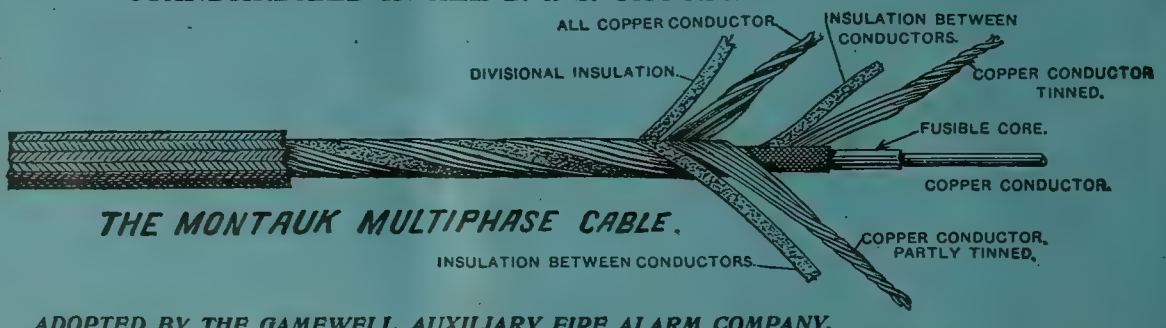

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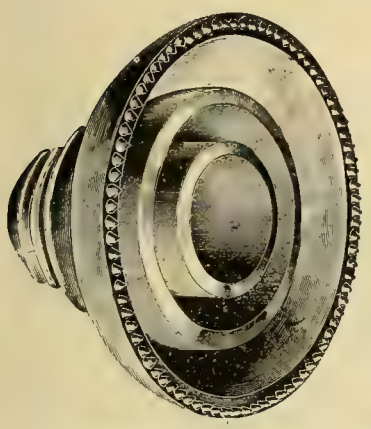

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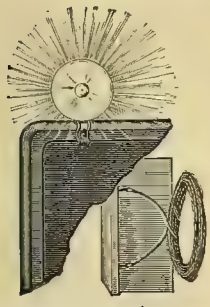

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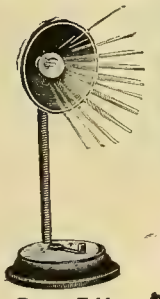

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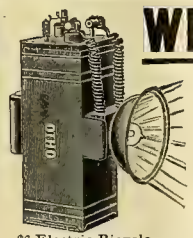

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HARDTMUTH CORED AND SOLID CARBONS

FOR DIRECT CURRENT ARC LAMPS.

WE HAVE IN STOCK THE FOLLOWING SIZES:

CORED CARBONS.

Diameter. Length.
5-16 in. x 6 in., 6½ in., 7 in., 7½ in. and 8 in.
3-8 in. x 7 in., 8 in., 9 in., 9½ in., 10 in. and 12 in.
7-16 in. x 6 in., 7 in., 8 in., 9 in., 9½ in., 10 in. and 12 in.
1-2 in. x 6 in., 7 in., 7½ in. and 8 in.
5-8 in. x 12 in.

SOLID CARBONS.

Diameter. Length.
7-16 in. x 7 in. and 10 in.
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Having received a large consignment of these Carbons just before the new tariff went into effect, we are prepared to make very low prices. Send for price list.

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DIRECT CIRCUITS.

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3 TO 5 AMPERES.

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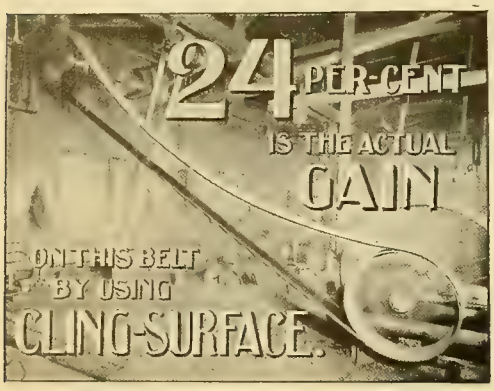

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Hodge, Walsh & Loring.
Stewart Electrical Co.
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Partrick, Carter & Wilkins.
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Simplex Electrical Co.
Washburn & Moen Mfg. Co.
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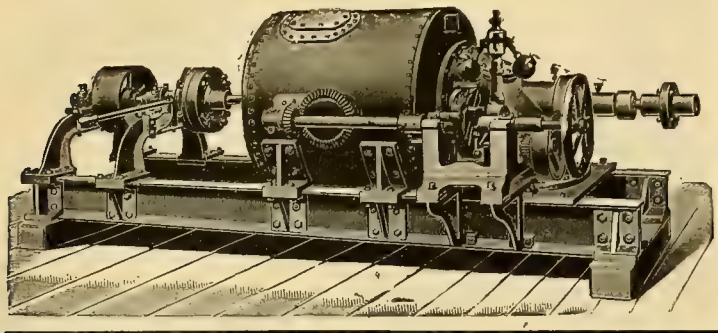
Victor Turbines Operating Dynamos.



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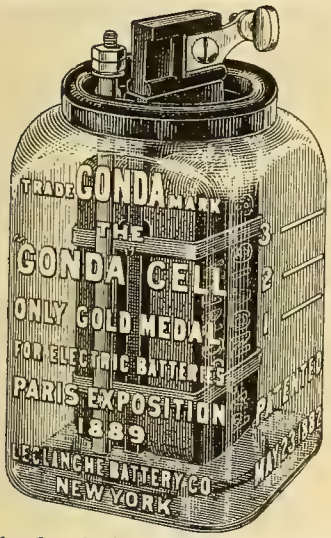

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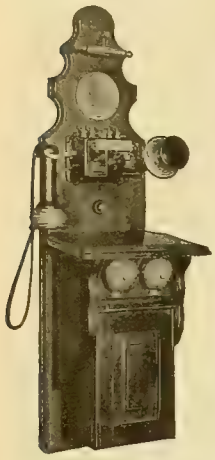

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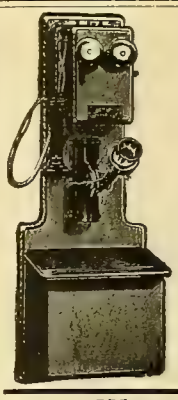

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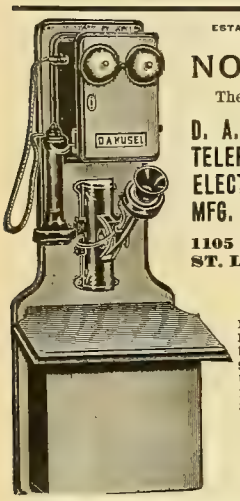

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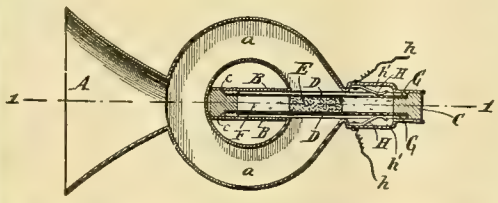

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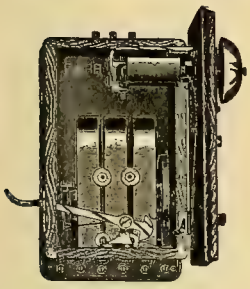

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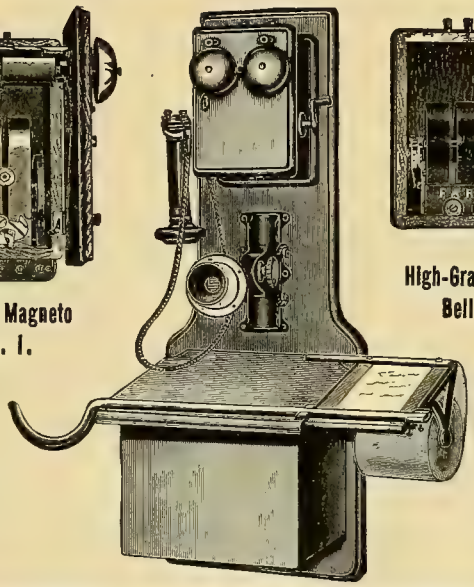

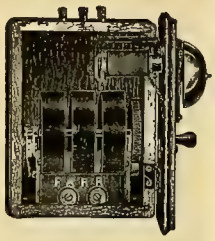

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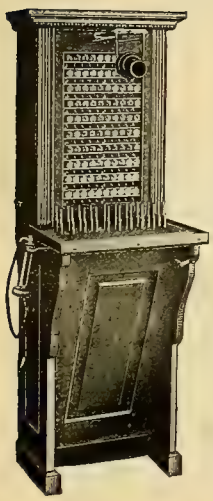

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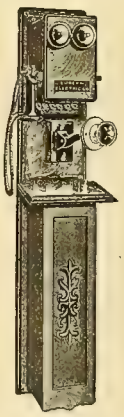

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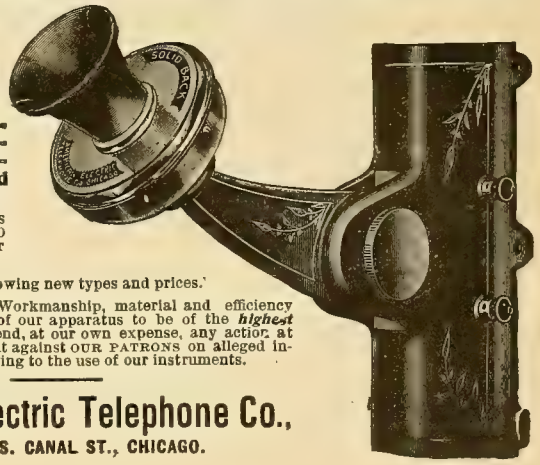

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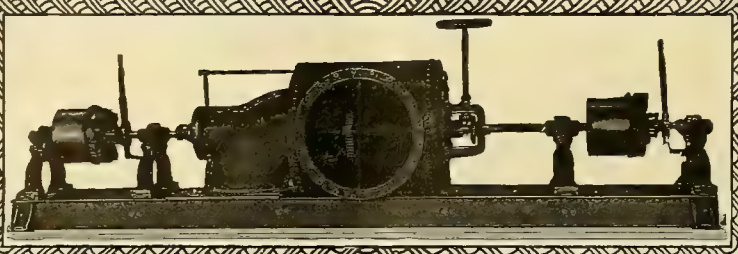

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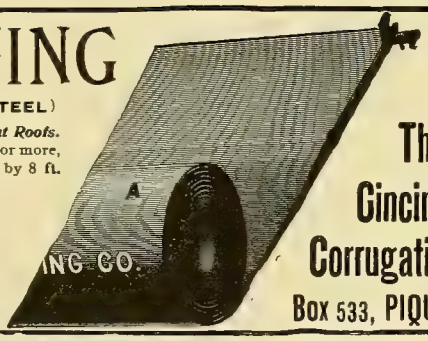

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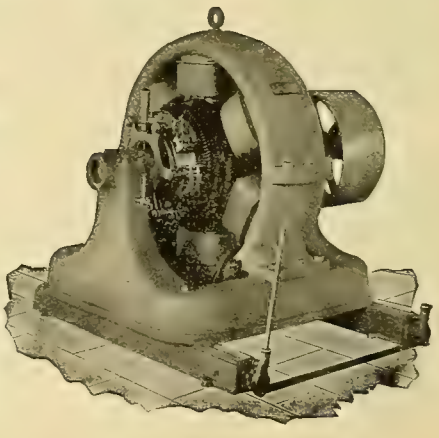

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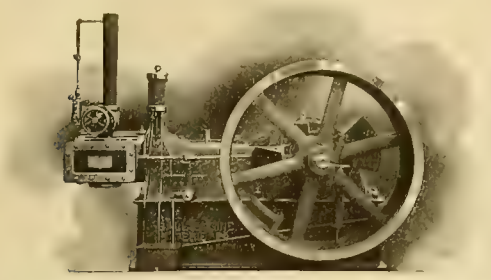

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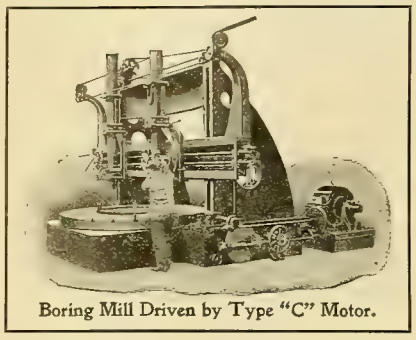

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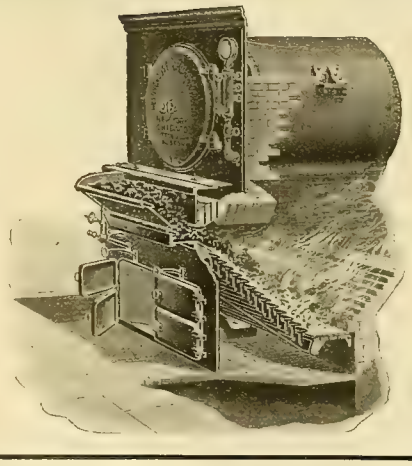

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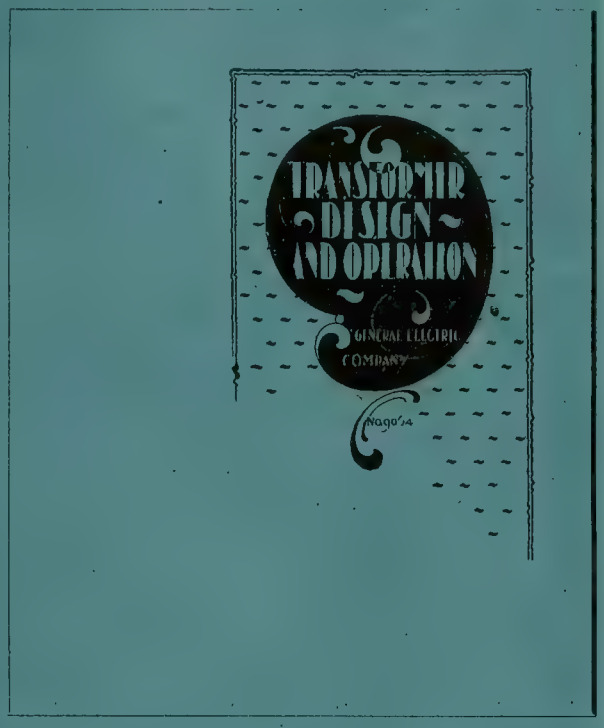

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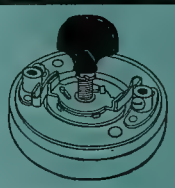

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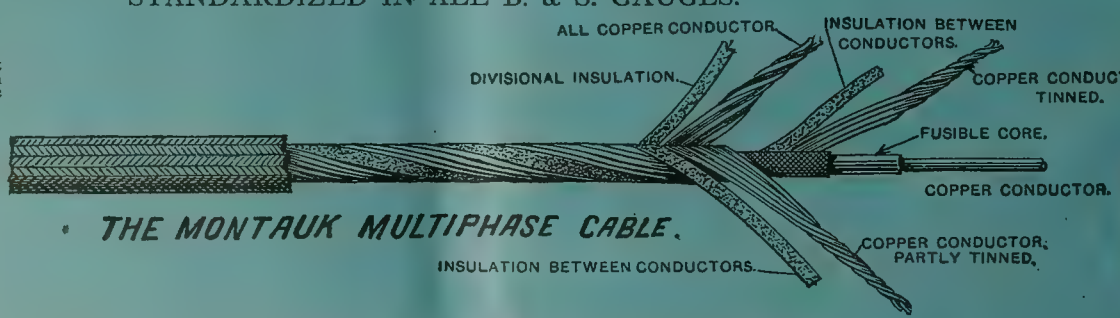

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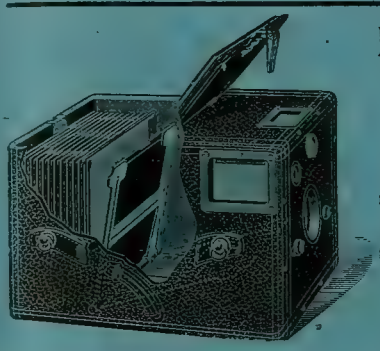

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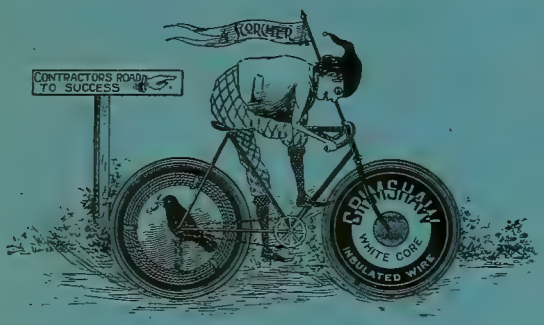

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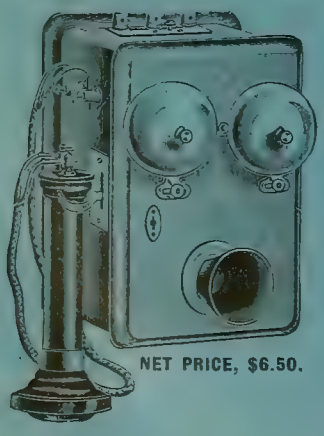

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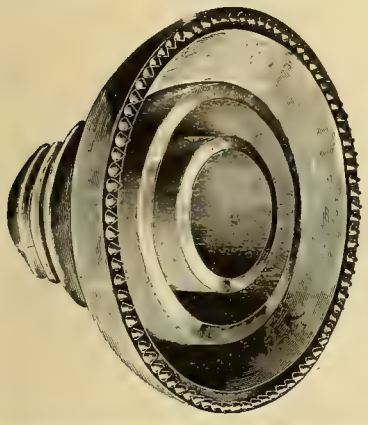

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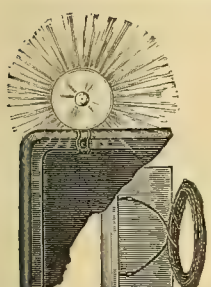

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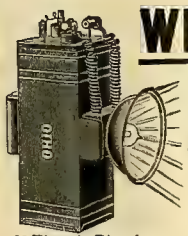

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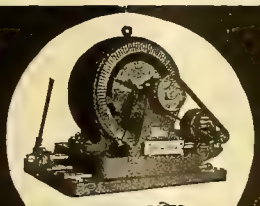

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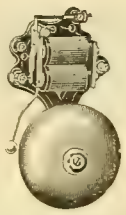

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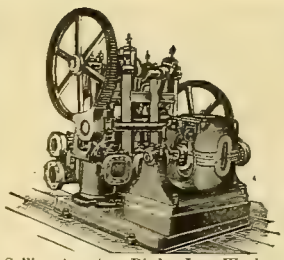

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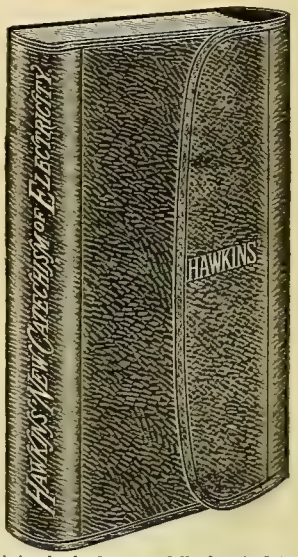

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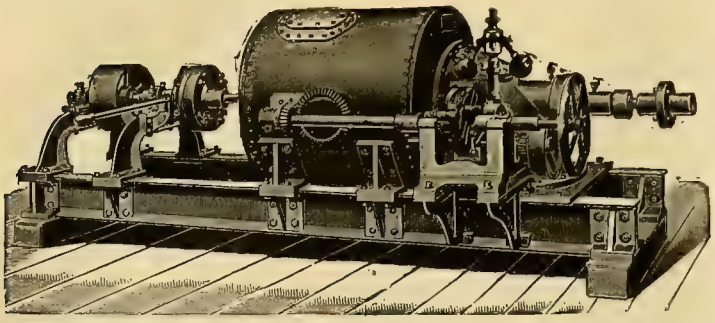

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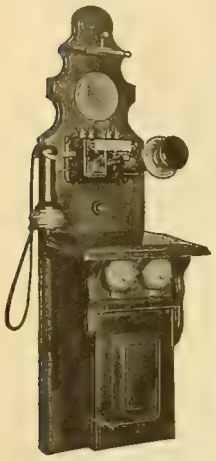

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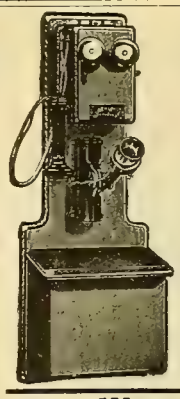

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At a mile-a-minute crack,
Do you ever note the rhythm
Of the wheels along the track?
Is there any great composer
Of sharps and flats and bars
Can equal in his cadences
The music of the cars?

Whether dashing through the meadow,
Or the tunnel's choking grime,
You will never hear them falter
From the measured beat of time;
Charging wildly 'mongst the mountains,
Or by the river's bank,
You will always find them playing—
Click-clickety-click-clank.

Every air that has been written
Since the days of wicked Cain
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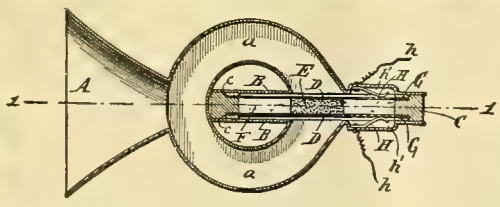

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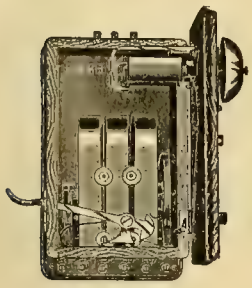

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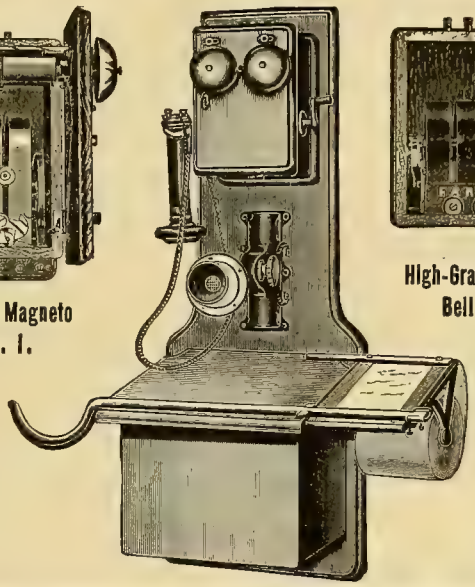

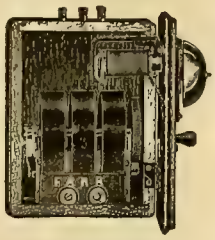

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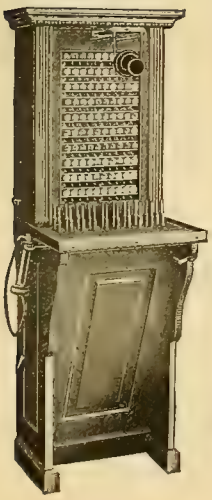

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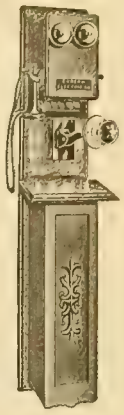

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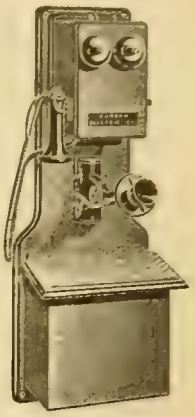

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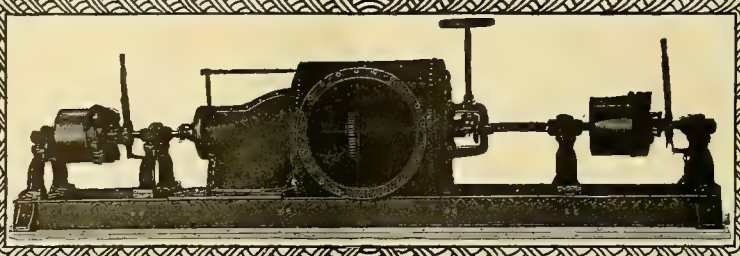

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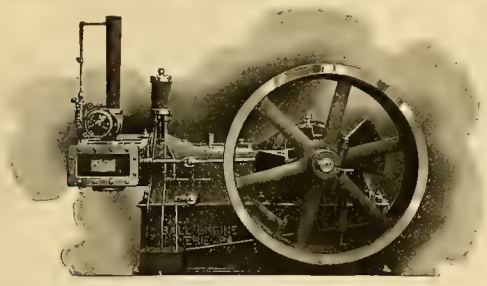

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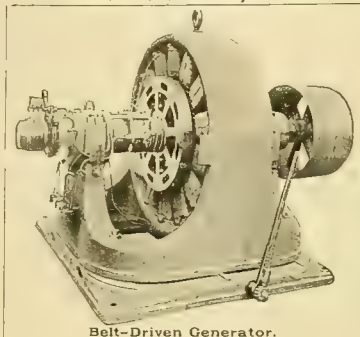

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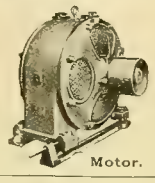

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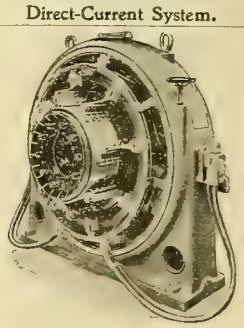

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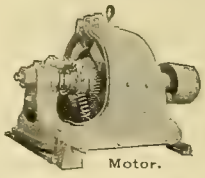

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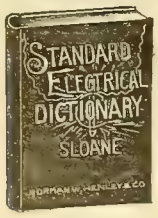

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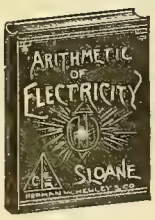

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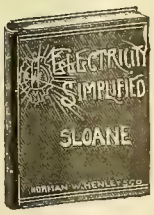

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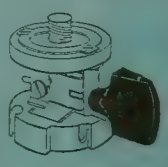
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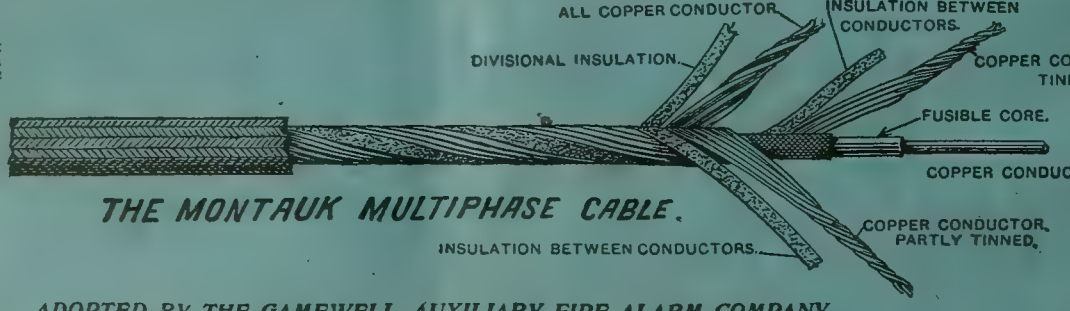

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